

Coso Monitoring Program
October 1996 Through September 1997

by
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Public Works Department

DECEMBER 1997

NAVAL AIR WEAPONS STATION
CHINA LAKE, CA 93555-6100



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FOREWORD

This report presents the status of the Coso Monitoring Program conducted for the period October 1996 through September 1997 by the Naval Air Weapons Station (NAWS), China Lake, Calif. The investigation, funded under the NAWS Coso Geothermal Development Program, is being conducted to provide baseline information on hydrology and surface geothermal activity in the Coso Hot Springs area.

This report was reviewed for technical accuracy by Allan M. Katzenstein and Steven C. Bjornstad (NAWS 83G000D).

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13. ABSTRACT <i>(Maximum 200 words)</i> (U) The Coso Monitoring Program is a continuing effort in support of the Navy's geothermal resources within the Coso Known Geothermal Resource Area (Coso KGRA). A substantial body of reports has been established on this project (15 technical publications) and the project is essentially the same year to year, therefore much of the text of each report reiterates previously published information. This year's report concentrates on data presentation and interpretation; the reader is referred to the 1993/1994 summary report (NAWS-CL TP 006) for detailed descriptions of the overall project and the individual sites monitored.			
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INTRODUCTION

The Coso Monitoring Program was initiated in 1978 to gather baseline data on the surface and near-surface geothermal activity at Devils Kitchen and Coso Hot Springs which are the main active thermal features within the Coso Known Geothermal Resource Area (Coso KGRA). These two sites are also located inside the boundaries of the Naval Air Weapons Station (NAWS), China Lake, Calif. This report represents the twentieth consecutive year of continuous data collection at these sites by Geothermal Program Office personnel.

The format of the report for the current reporting period hasn't been changed from last year's report. A substantial body of reports has been established on this project (15 technical publications) and the project is essentially the same year to year, therefore much of the text of each report reiterates previously published information. This year's report concentrates on data presentation and interpretation and the reader is referred to the 1993/1994 summary report (Reference 1) for detailed descriptions of the overall project and the individual sites monitored.

Seasonal and diurnal variations of the thermal activity in these hot spring areas continue to be evident. Overall, the level of activity has been very stable during this reporting period.

Monitoring sites of the Coso Hot Springs area and type of data collected at each site are presented in Table 1. The location of each site is shown in Figure 1.

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TABLE 1. Monitoring Functions and Locations.

Monitored sites	Continuous steam flow	Wellhead pressure	Periodic water level	Periodic water temperature	Water level photography	Ambient temperature	Barometric pressure	Relative humidity	Wind speed and direction
Schober's Resort (Wells 4A-2, 3)	X								
Well 4A-4			X ^a						
Well 4H-4	X			X ^b					
Well 4P-1				X ^b					
Well 4H-8 (Coso No. 1)		X ^c							
Devils Kitchen					X ^b				
Observation Well No. 1					X ^b				
Observation Well No. 2						X ^b			
South Pool						X			
Weather Station							X	X	X

^aLess than weekly monitoring.^bWeekly monitoring.^cWeekly shut-in wellhead pressures.

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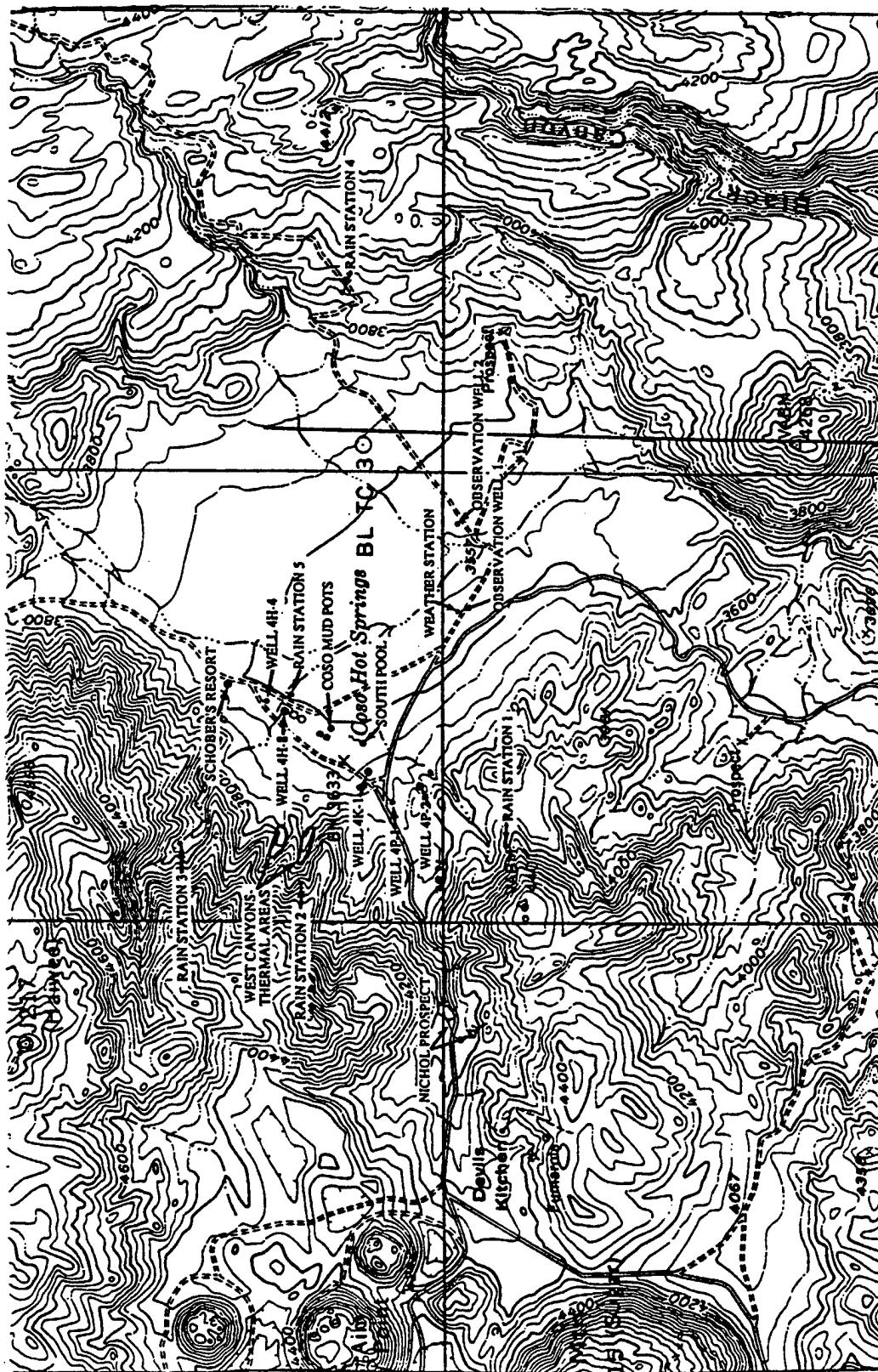


FIGURE 1. Coso Known Geothermal Resources Area Monitoring Sites.

STEAM FLOW AND TEMPERATURE MONITORING

Steam flow has been gauged at several shallow wells since the monitoring program was first initiated. While the measured steam flow from these wells represents an uncertain fraction of the total steam flow from the Coso thermal area, it does serve to monitor the relative hydrothermal activity in the area over time. Several sites are currently included in the study: Devils Kitchen, the Stove Pipe Eight-Inch Well (4H-4), and Schober's Resort (4A-2 and 3).

Steam flow data are recorded at each site using an ITT Barton differential pressure unit AdScan recorder. The data are down-loaded to a pocket-size flash memory card. The information stored in the flash memory card is then transferred into Paradox databases.

A periodic maintenance schedule was established in house to ensure that the recording units are maintained at peak efficiency and reliability. Additionally, a contract was established with ITT Barton for yearly maintenance and calibration of the Barton meter/AdScan units. The AdScan units and the Barton meters were calibrated on 17 April 1997. In August of 1997 the resistor pods, which send the electrical signal to the AdScan unit, were replaced in the Barton meters. Since replacing the resistor pods the AdScan meters have resumed their constant readings.

DEVILS KITCHEN

Steam flow at Devils Kitchen is monitored using a Barton 25-inch water column differential pressure unit (DPU) and AdScan recorder. Daily high, low, and average steam flow data collected at Devils Kitchen for the period of this report are presented in the Appendix. Figure 2 shows a summary graph of Devils Kitchen steam flow activity from October 1996 through September 1997. From late August 1997 through September 1997 the steam flow data recorded at Devils Kitchen (Figure 2) showed a marked increase. The increase does not appear to reflect an actual increase in the steam flow, but may be a mechanical problem in the AdScan recording unit. This situation is still being assessed.

STOVE PIPE EIGHT-INCH STEAM WELL (4H-4)

The daily steam flow for well 4H-4 is presented in the Appendix. This site is equipped with a 50-inch water column DPU and AdScan recorder. Figure 3 shows a summary graph of steam flow activity from October 1996 through September 1997. Data covering the period of 7-10 September 1997 were lost as the result of a data transfer error.

SCHOBER'S WELLS (4A-2 AND 4A-3)

The daily steam flow for wells 4A-2 and 4A-3 at Schober's Resort are presented in the Appendix. This site is equipped with a 50-inch water column DPU and AdScan recorder. Figure 4 shows a summary graph of steam flow activity from October 1996 through 30 September 1997. Data covering the period of 20-26 November 1996 and 10-16 July 1997 were lost as a result of a data transfer error.

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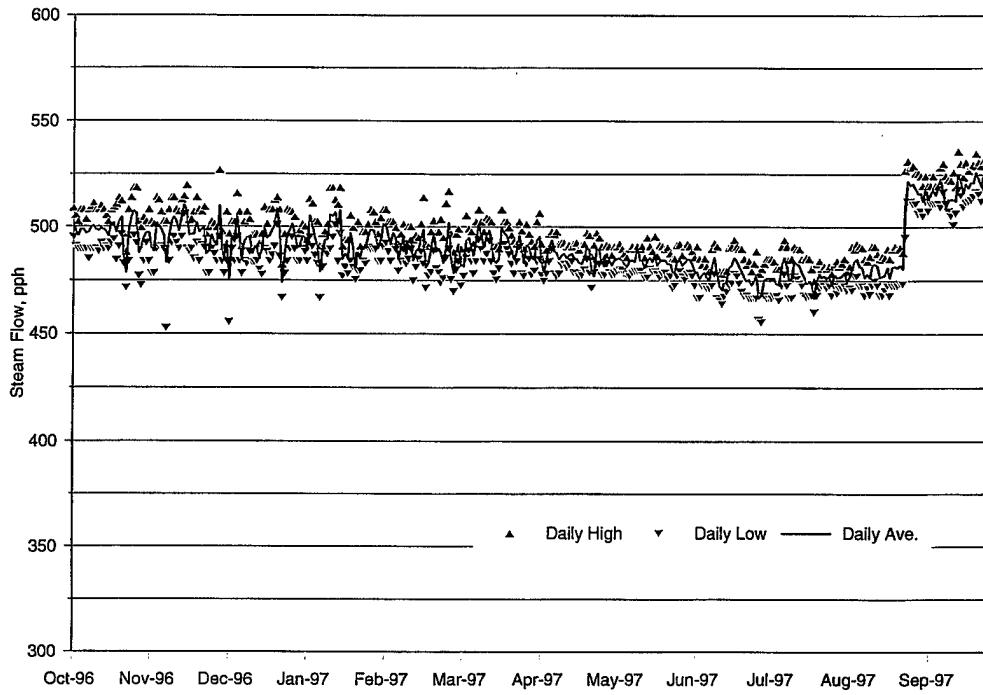


FIGURE 2. Devil's Kitchen Steam Flow, October 1996 through September 1997.

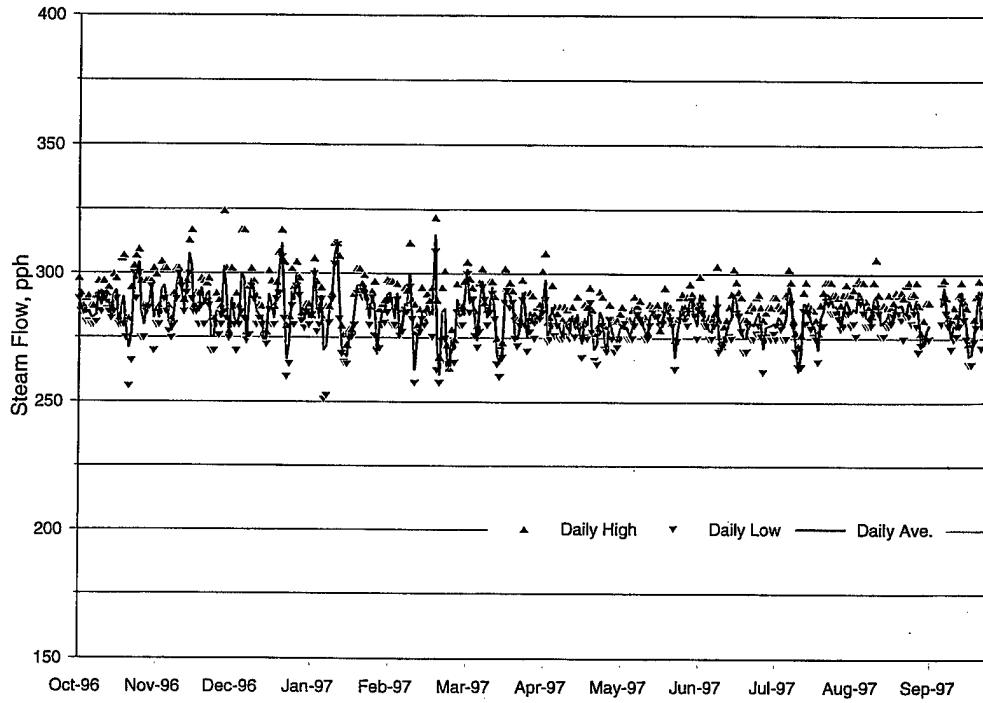


FIGURE 3. Well 4H-4 Steam Flow, October 1996 through September 1997.

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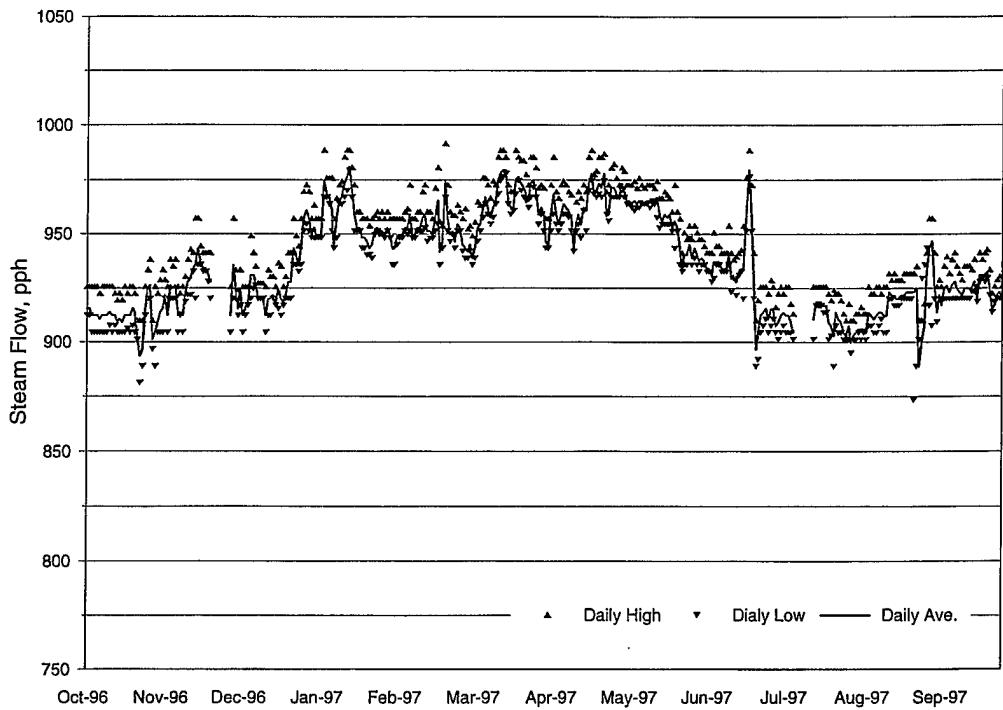


FIGURE 4. Wells 4A-2 and 4A-3 Steam Flow, October 1996 through September 1997.

**COSO HOT SPRINGS MUDFIELD
PHOTOGRAPHIC RECORD**

A weekly photographic record was initiated in January 1978 to document the fluctuation in fluid levels in several of the more prominent mud pots in the Coso KGRA. Over the years the photo record has provided a clear picture of this hot springs thermal activity. It has demonstrated the sensitivity of the hot springs to both seasonal weather changes and individual weather events, such as summer thunderstorms. It has also chronicled the changes in thermal activity that occurred throughout the Coso Hot Springs area in the late 198s. This weekly photo record was continued through this reporting period and is catalogued and stored at the Geothermal Program Office.

Selected photographs, Figures 5 through 13, show the typical level of thermal activity in the hot springs area throughout the past year.



FIGURE 5. Resort Mud Pot Area, August 1997.

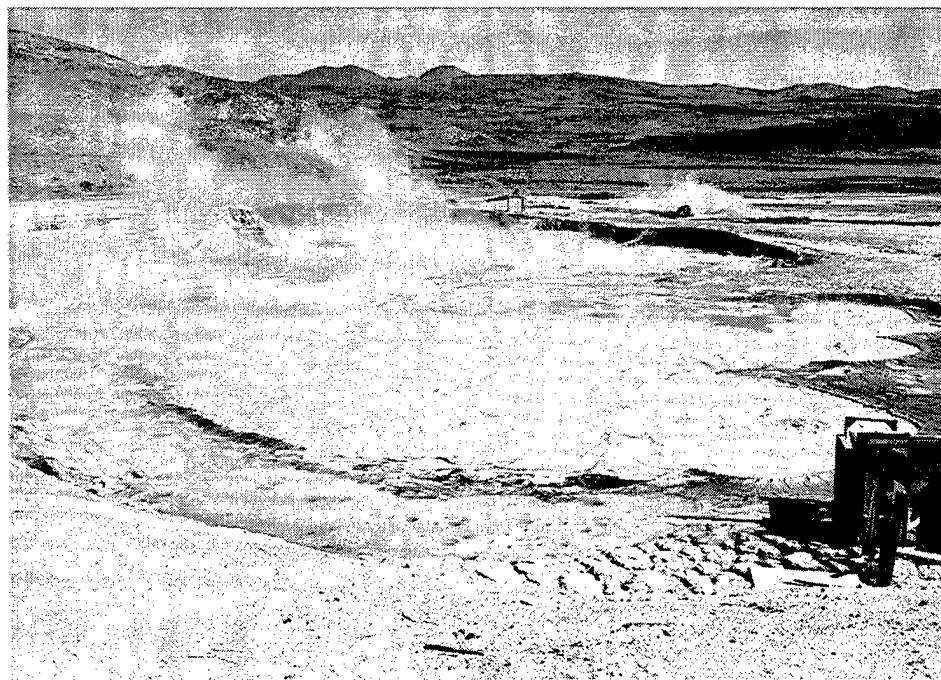


FIGURE 6. South Pool, High Water Level, May 1997.

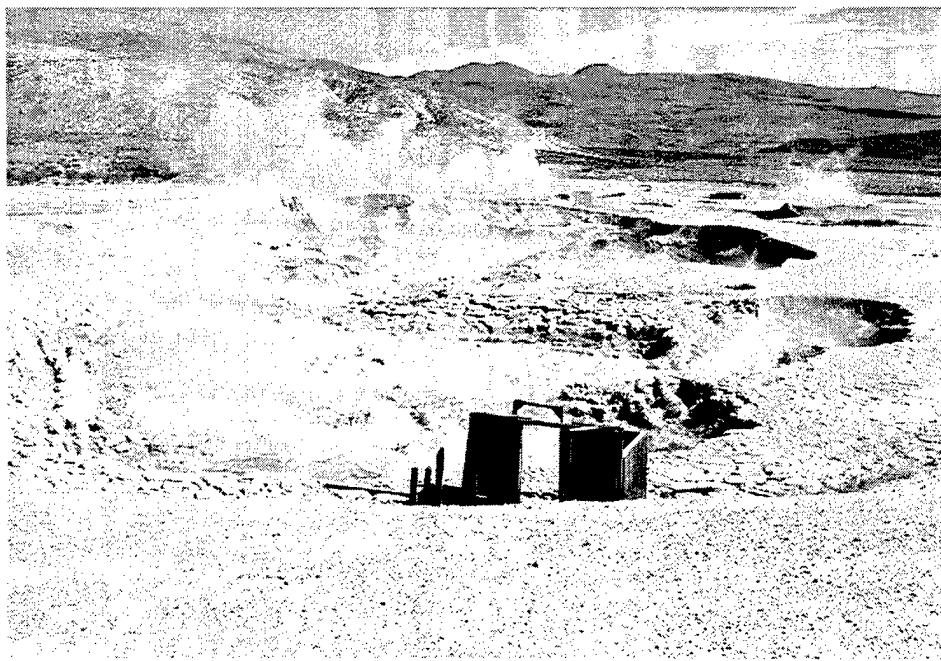


FIGURE 7. South Pool, Low Water Level, October 1996.

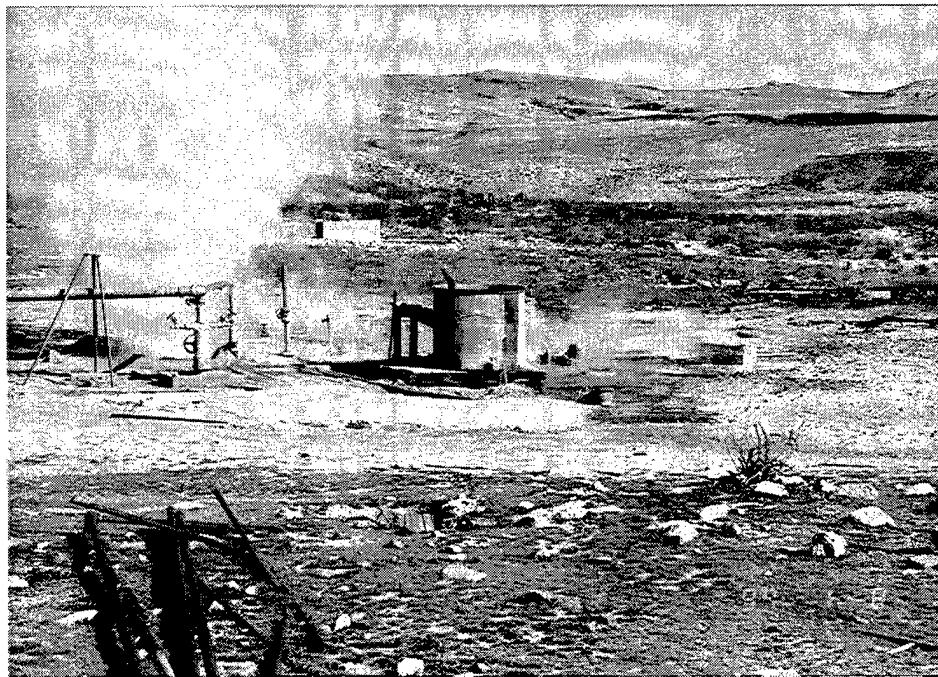


FIGURE 8. Schober's Resort Area.

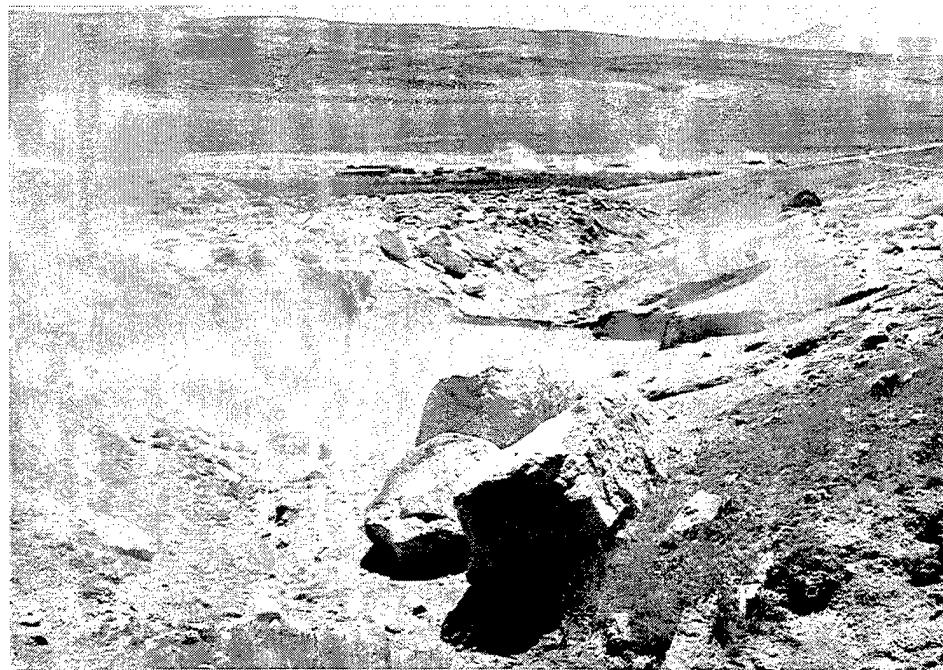


FIGURE 9. West Canyon, Looking East Down Canyon, September 1997.

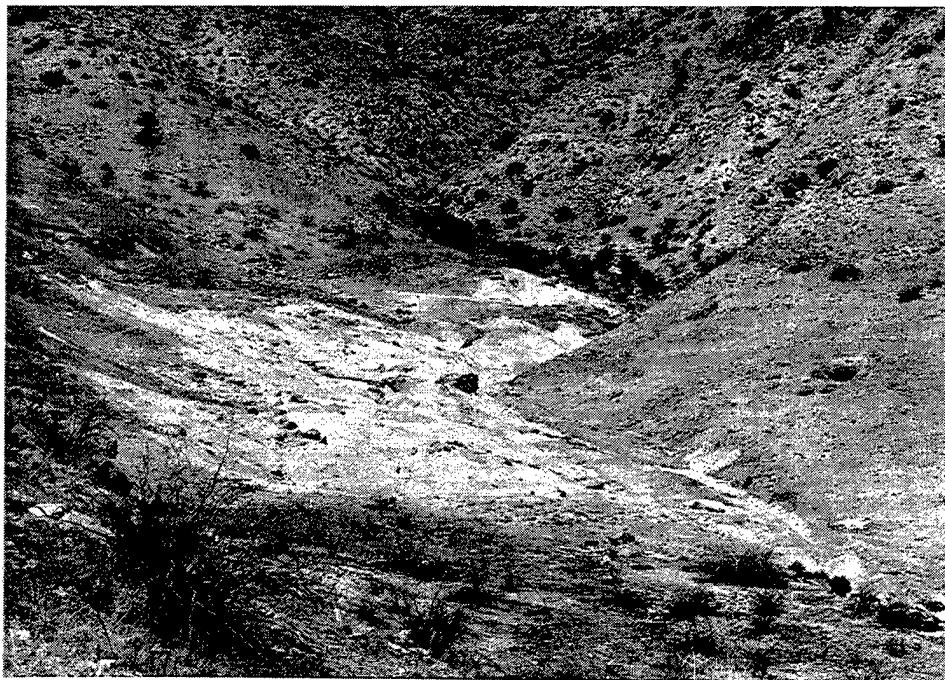


FIGURE 10. Northern West Canyon Land Slump, March 1997.

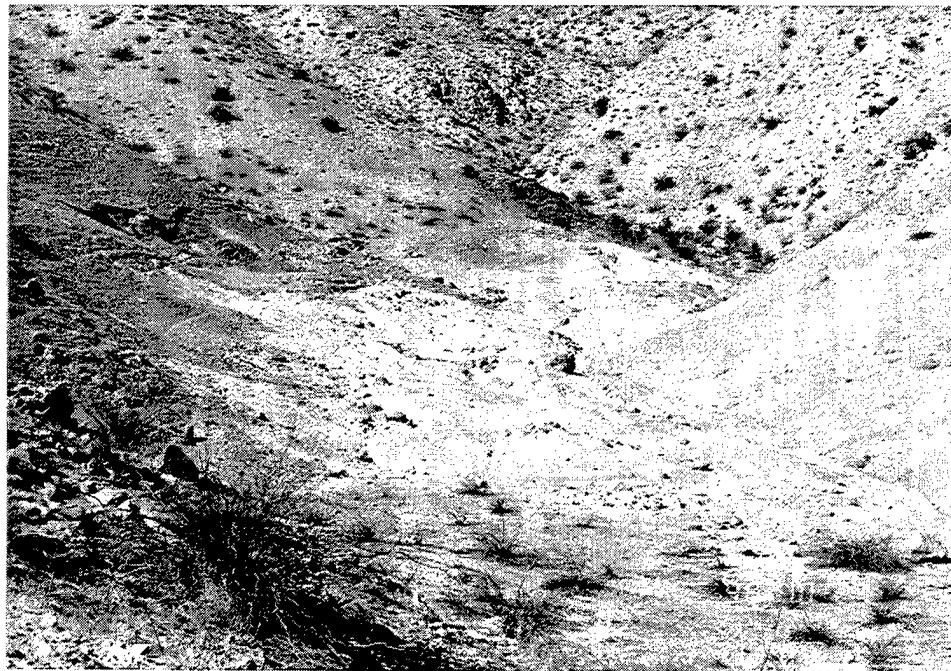


FIGURE 11. Northern West Canyon Land Slump, October 1997.

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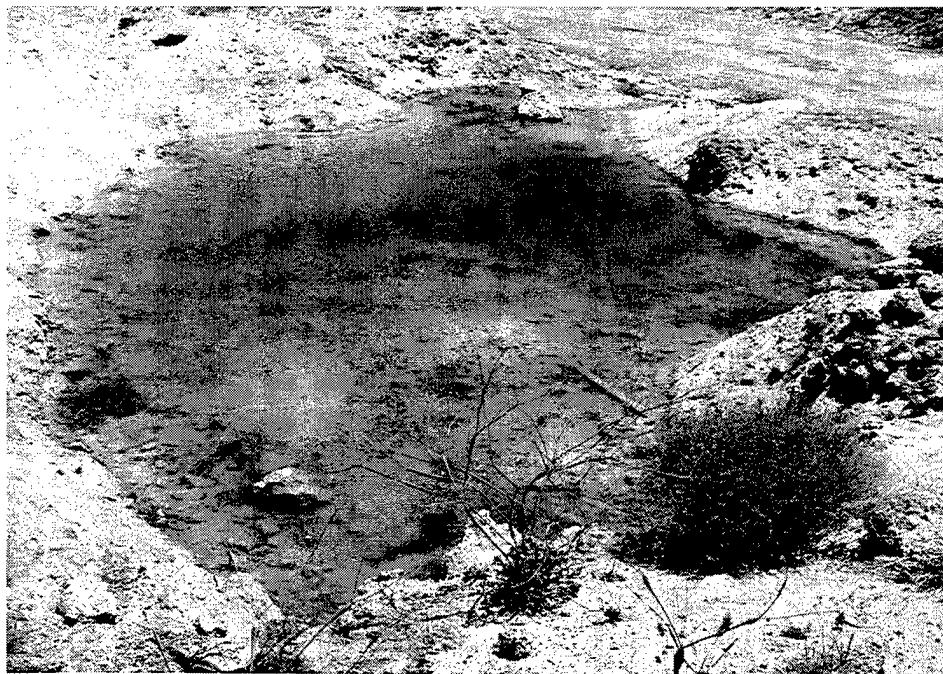


FIGURE 12. Nichol Prospect Warm Pool, March 1997.



FIGURE 13. Nichol Prospect Warm Pool, August 1997.

WATER LEVEL MONITORING

OBSERVATION WELLS

Groundwater levels are monitored in four wells. Bi-weekly measurements are taken at wells 4P-1, OB-1 and OB-2, while the water level of another well, Coso No. 1 (4H-8), is determined indirectly from temperature logs and weekly wellhead pressure readings. These level data are listed in Table 2. Figure 14 shows a summary graph of observation well water levels from 1980 to the present. Depth to water data have been translated to true elevation.

The fluid level elevation in well 4P-1 appears to have stabilized at 3613.3 feet above sea level (ASL) during this monitoring period. Well 4P-1 is a hot, steam condensate well and is located on the upthrown side of the Coso Hot Springs fault, about 150 feet from the fault line, toward the south end of the hot springs area. It is completed in alluvial fill material. As discussed in Reference 2, this well appears to tap a small perched aquifer that is not directly connected to the regional aquifer.

Observation wells OB-1 and OB-2 are water wells located in the Upper Coso Basin about three-quarters of a mile east of the fault line. Both of these wells are completed in sedimentary, valley fill material. The water level elevation in OB-1 continues the decline described in previous reports, dropping from about 3432 feet ASL in 1988 to about 3385.6 feet ASL by September 1997. The water level in OB-2, however, rose about 10 feet during 1989 and 1990. This level appears to have stabilized at about 3365.5 feet ASL.

Coso No. 1 is located toward the north end of the Coso Hot Springs fault and is completed in bedrock. The fluid level in Coso No. 1 declined slightly from 3473 to about 3465 feet ASL between 1978 and October 1987. At that lowered fluid level, the well began to boil. The fluid level dropped rapidly to about 3410 feet ASL by September 1988, and the wellbore became plugged with salt and scale. Coso No. 1 was rehabilitated in 1993 and shut-in to reduce boiling and scaling. The current fluid level (determined from the temperature gradient log) is at about 3294 feet ASL.

Shut-in wellhead pressures for Coso No. 1 are recorded weekly from both the 4-inch wellbore and the 7-inch intermediate casing around the wellbore. The wellbore is completed to 370 feet in bedrock, while the intermediate casing is set to 194 feet at the alluvium/ bedrock interface. Table 3 is a listing of the current year's recorded pressures. Figure 15 is a summary graph of these pressures from November 1993 to the present.

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TABLE 2. Observation Well Water Level Data.

Date	Water level elevations, ft, above mean sea level (AMSL)			
	Ground level at well location, ft, AMSL			Ground level, ft, AMSL
	4P-1	OB-1	OB-2	Coso 1
	3662.0	3570.0	3560.0	3615.0
Water level measurements				Water level
	4P-1	OB-1	OB-2	Coso 1
	3613.3	3385.6	3365.5	
2 Oct 96	3613.3	3385.6	3365.5	
9 Oct 96	3612.1	3385.6	3365.5	
16 Oct 96	3613.3	3385.6	3365.5	
23 Oct 96	3613.3	3386.8	3365.5	
30 Oct 96	3613.3	3386.8	3365.5	
6 Nov 96	3613.3	3386.8	3365.5	
13 Nov 96	3613.3	3386.8	3365.5	
20 Nov 96	3613.3	3386.8	3365.5	
27 Nov 96	3613.3	3386.8	3365.5	
4 Dec 96	3613.3	3386.8	3365.5	
11 Dec 96	3612.1	3387.9	3364.3	
18 Dec 96	3612.1	3385.6	3365.5	
26 Dec 96	3612.1	3385.6	3365.5	
2 Jan 97	3612.1	3385.6	3365.5	
8 Jan 97	3612.1	3385.6	3365.5	
16 Jan 97	3612.1	3385.6	3365.5	
23 Jan 97	3612.1	3385.6	3365.5	
5 Feb 97	3613.3	3384.5	3365.5	
12 Feb 97	3612.1	3385.6	3365.5	
19 Feb 97	3612.1	3384.5	3364.3	
26 Feb 97	3613.3	3385.6	3364.3	
5 Mar 97	3613.3	3384.5	3365.5	
12 Mar 97	3612.1	3386.8	3365.5	
19 Mar 97	3614.5	3383.8	3364.3	
26 Mar 97	3613.3	3384.5	3365.5	3294.0
2 Apr 97	3612.1	3385.6	3365.5	
9 Apr 97	3612.1	3385.6	3365.5	
17 Apr 97	3613.3	3384.5	3365.5	
24 Apr 97	3613.3	3385.6	3365.5	
30 Apr 97	3613.3	3385.6	3365.5	

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TABLE 2. (Contd.)

Date	Water level elevations, ft, AMSL			
	Ground level at well location, ft, AMSL			Ground level, ft, AMSL
	4P-1	OB-1	OB-2	Coso 1
	3662.0	3570.0	3560.0	3615.0
Water level measurements				Water level
	4P-1	OB-1	OB-2	Coso 1
7 May 97	3613.3	3385.6	3365.5	
14 May 97	3613.3	3385.6	3365.5	
21 May 97	3613.3	3385.6	3365.5	
28 May 97	3613.3	3385.6	3365.5	
4 Jun 97	3613.3	3385.6	3365.5	
11 Jun 97	3613.3	3385.6	3364.3	
18 Jun 97	3613.3	3385.6	3364.3	
25 Jun 97	3613.3	3385.6	3364.3	
2 Jul 97	3613.3	3384.5	3365.5	
9 Jul 97	3613.3	3385.6	3365.5	
16 Jul 97	3613.3	3385.6	3365.5	
23 Jul 97	3613.3	3385.6	3364.3	
30 Jul 97	3613.3	3385.6	3364.3	
6 Aug 97	3613.3	3385.6	3364.3	
13 Aug 97	3613.3	3385.6	3365.5	
20 Aug 97	3613.3	3385.6	3365.5	
27 Aug 97	3613.3	3385.6	3365.5	
3 Sep 97	3613.3	3385.6	3365.5	
10 Sep 97	3613.3	3385.6	3365.5	
17 Sep 97	3613.3	3385.6	3365.5	
24 Sep 97	3613.3	3385.6	3365.5	

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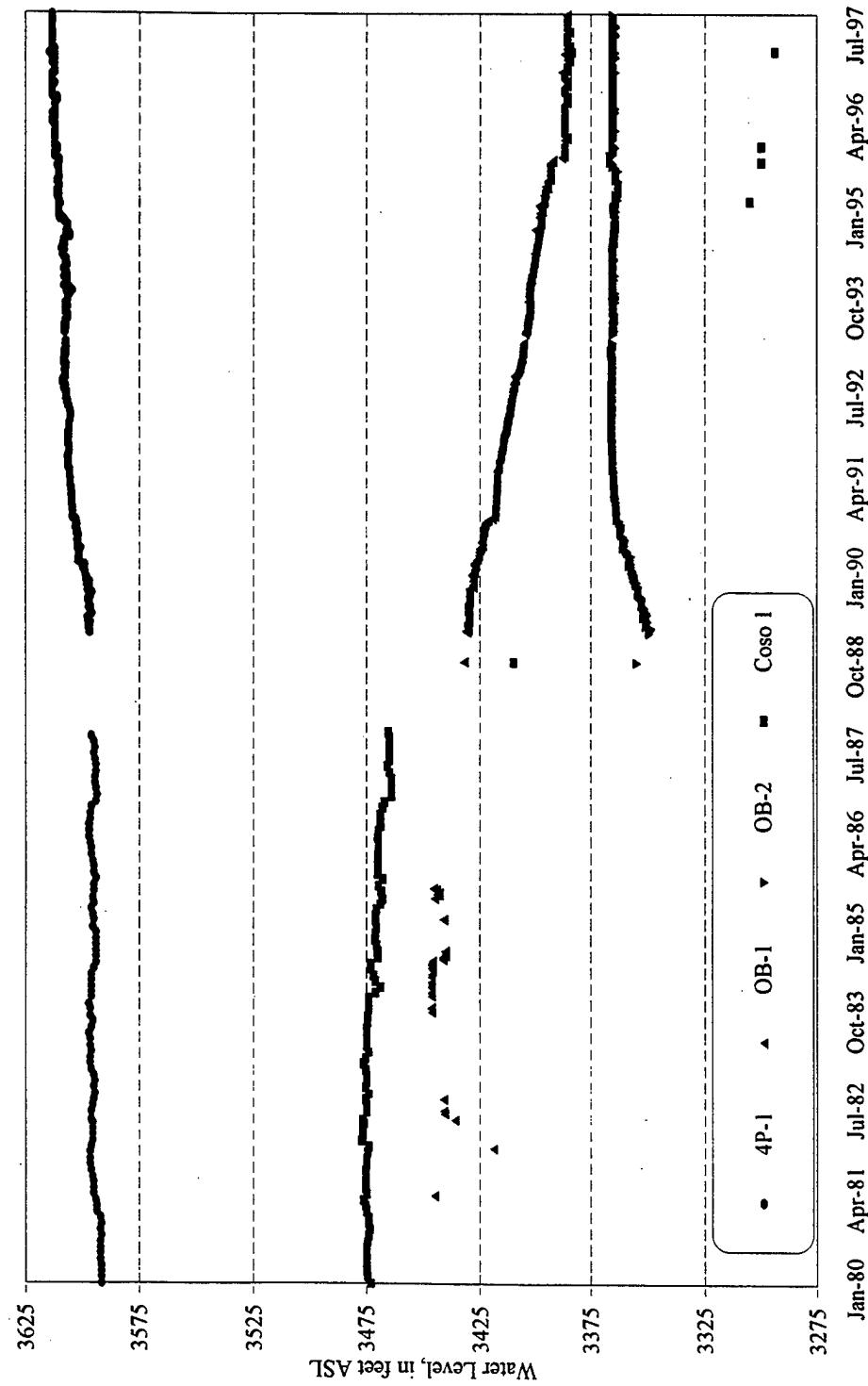


FIGURE 14. Water Levels in Coso Observation Wells, January 1980 Through September 1997.

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TABLE 3. Shut-in Wellhead Pressure, Coso No. 1.

Date	7-inch Casing (psig)	4-inch Casing (psig)
2 Oct 96	24.5	20.5
9 Oct 96	24.5	20.5
16 Oct 96	25.0	20.5
23 Oct 96	24.5	20.5
30 Oct 96	24.5	20.5
6 Nov 96	24.5	20.5
13 Nov 96	25.0	20.5
20 Nov 96	24.5	20.5
27 Nov 96	24.5	20.5
4 Dec 96	24.5	20.5
11 Dec 96	24.5	20.5
18 Dec 96	24.5	20.5
26 Dec 96	25.0	20.5
2 Jan 97	24.5	20.5
8 Jan 97	24.5	20.5
16 Jan 97	24.5	20.5
23 Jan 97	25.0	20.5
5 Feb 97	25.0	20.5
12 Feb 97	25.0	20.5
19 Feb 97	25.0	20.5
26 Feb 97	24.5	20.5
5 Mar 97	24.5	20.5
12 Mar 97	25.0	20.5
19 Mar 97	25.0	20.5
26 Mar 97	25.0	20.5
2 Apr 97	25.0	20.5
9 Apr 97	25.0	20.5
17 Apr 97	25.0	20.5
24 Apr 97	24.5	20.5
30 Apr 97	25.0	20.5
7 May 97	25.0	20.5
14 May 97	25.0	21.0
21 May 97	25.5	21.0
28 May 97	25.5	21.0
4 Jun 97	25.5	21.0
11 Jun 97	25.5	21.0
18 Jun 97	25.5	21.0
25 Jun 97	25.5	21.0
2 Jul 97	25.5	21.0
9 Jul 97	25.5	21.0
16 Jul 97	25.5	21.0
23 Jul 97	25.5	21.0
30 Jul 97	25.5	21.0
6 Aug 97	25.0	20.5
13 Aug 97	25.0	21.5
20 Aug 97	25.0	21.5
27 Aug 97	25.0	21.5
3 Sep 97	25.0	21.5
10 Sep 97	25.5	21.0
17 Sep 97	25.5	21.0
24 Sep 97	25.5	21.0

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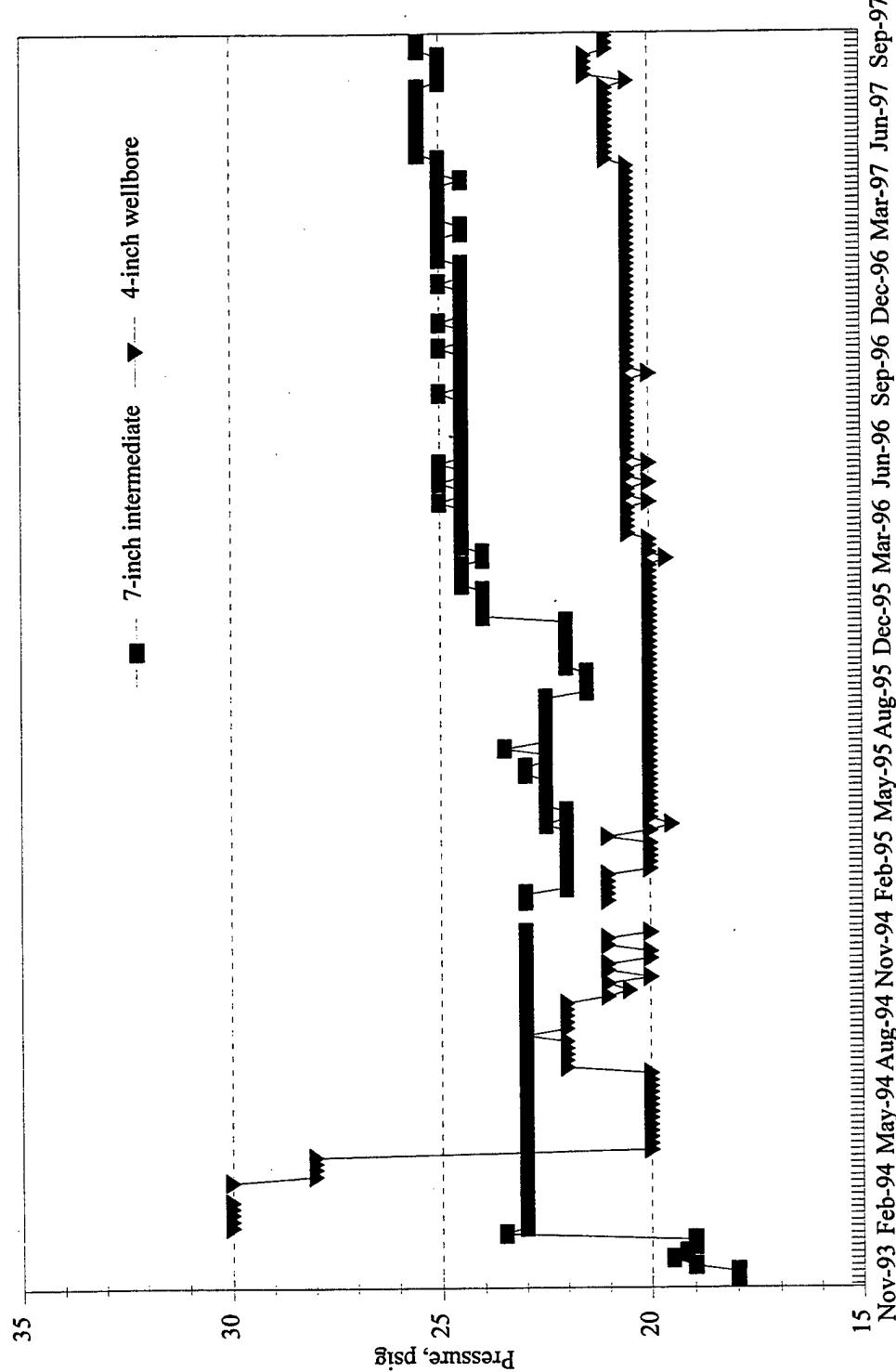


FIGURE 15. Shut-in Wellhead Pressure, Coso Well No. 1, November 1993 to September 1997.

SOUTH POOL

The South Pool water level has continued the pattern of seasonal fluctuations throughout this reporting period, ranging from a low of 3612.2 feet in October 1996 to a high of 3620.7 feet in February of 1997 (Table 4). The pool's temperature is periodically measured, as conditions permit. Water temperatures for this period continued to average above 200 degrees Fahrenheit. The temperature and water elevations of the pool for January 1988 through September 1997, the period of increased activity, are shown graphically in Figure 16, while the pool elevation recorded for the entire monitoring program period is shown in Figure 17.

TABLE 4. South Pool Elevation and Temperature Changes.

Date	Elevation ft	Temperature °F	Date	Elevation ft	Temperature °F
2 Oct 96	3616.5	212	9 Apr 97	3620.3	206
9 Oct 96	3616.7	210	17 Apr 97	3620.3	205
16 Oct 96	3616.9	211	24 Apr 97	3620.2	204
23 Oct 96	3617.2	210	30 Apr 97	3620.0	205
30 Oct 96	3617.6	211	7 May 97	3619.8	206
6 Nov 96	3617.9	209	14 May 97	3619.6	204
13 Nov 96	3618.4	206	21 May 97	3619.6	205
20 Nov 96	3618.6	207	28 May 97	3619.8	205
27 Nov 96	3618.7	205	4 Jun 97	3618.5	206
4 Dec 96	3619.3	202	11 Jun 97	3618.4	204
11 Dec 96	3619.3	204	18 Jun 97	no data	193
18 Dec 96	3619.5	204	25 Jun 97	no data	194
26 Dec 96	3619.6	208	2 Jul 97	6318.5	no data
2 Jan 97	3619.5	204	9 Jul 97	6318.5	no data
8 Jan 97	3619.5	210	16 Jul 97	no data	no data
16 Jan 97	3620.1	202	23 Jul 97	3618.4	212
23 Jan 97	3620.3	206	30 Jul 97	3618.4	212
5 Feb 97	3620.4	205	6 Aug 97	3618.2	212
12 Feb 97	3620.3	210	13 Aug 97	3618.0	213
19 Feb 97	3620.4	207	20 Aug 97	3617.9	211
26 Feb 97	3620.7	205	27 Aug 97	3617.8	no data
5 Mar 97	3620.6	208	3 Sep 97	3617.9	210
12 Mar 97	3620.4	210	10 Sep 97	3617.7	211
19 Mar 97	3620.4	205	17 Sep 97	3617.7	211
26 Mar 97	3620.3	201	24 Sep 97	3617.8	211
2 Apr 97	3620.4	204			

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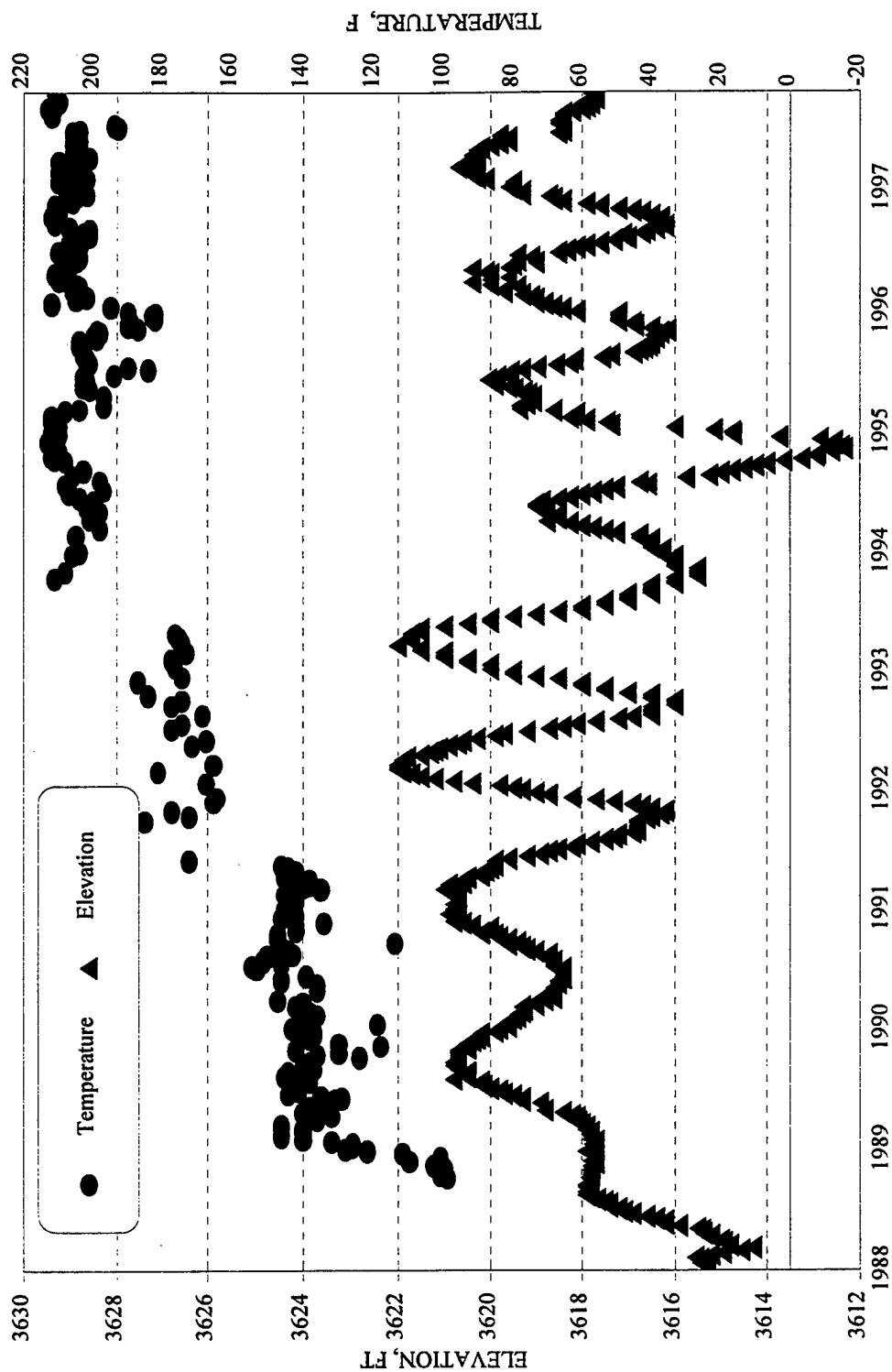


FIGURE 16. South Pool Elevation and Temperature, January 1988 Through September 1997.

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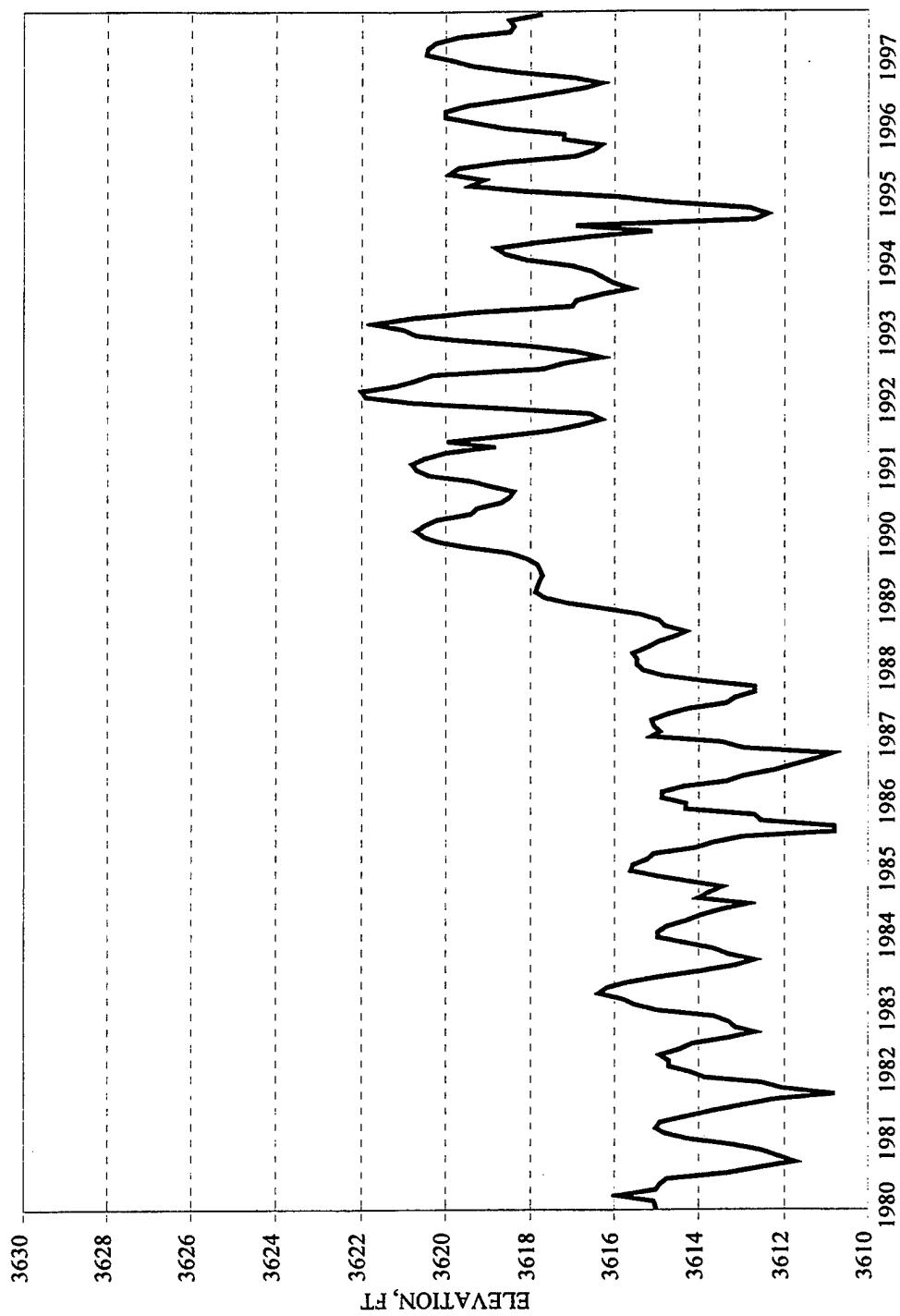


FIGURE 17. South Pool Elevations, 1980 Through September 1997.

RAINFALL AT COSO RESORT AREA AND ROSE VALLEY

Rainfall in the Coso Hot Springs basin is monitored at five rain station sites, as mapped in Figure 1. Instrumentation at each site consists of a battery-operated long-term strip recorder that is triggered by a tipping bucket. No rain data were recorded in tipping buckets 2 and 3 for the months of June 1997 and September 1997 due to mechanical problems. The Rose Valley data are collected at the Los Angeles Department of Water and Power Haiwee Reservoir Plant.

Data from the Coso rain stations and the Rose Valley data from the Haiwee power plant are presented in Table 5 and Figure 18. Comparative rainfall data for Coso Basin, Rose Valley, and the Indian Wells Valley (IWV) for the period 1966 through 1996 are shown in Table 6 and Figure 19. IWV data were gathered at Armitage Field, Naval Air Warfare Center Weapons Division (NAWCWPNS), and provided by a NAWCWPNS meteorologist.

TABLE 5. Rainfall Recorded at the Coso Rain Stations and Rose Valley.

Date	Coso Hot Springs area					Rose Valley	
	Tipping bucket stations (rainfall, in.)					Date	Rainfall, in.
	1	2	3	4	5		
21 Nov 96					0.04	30 Oct 96	0.15
9 Dec 96	0.63	0.43	0.32	0.38	0.10	31 Oct 96	0.25
10 Dec 96	0.03					22 Nov 96	0.56
11 Dec 96	0.10	0.11	0.09		0.02	10 Dec 96	0.39
22 Dec 96	0.32	0.23	0.19	0.21	0.06	11 Dec 96	0.26
25 Dec 96					0.08	12 Dec 96	0.07
27 Dec 96	0.03	0.60	0.80		0.04	22 Dec 96	0.23
30 Dec 96	0.04	0.70	0.90		0.08	23 Dec 96	0.4
31 Dec 96	0.01					27 Dec 96	0.2
2 Jan 97	0.02					28 Dec 96	0.02
6 Jan 97	0.04					1 Jan 97	0.03
15 Jan 97	0.02	0.80	0.12		0.05	2 Jan 97	0.23
16 Jan 97	0.05					13 Jan 97	0.12
22 Jan 97					0.02	15 Jan 97	0.15
						21 Jan 97	0.02

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TABLE 5. (Contd.)

Coso Hot Springs area						Rose Valley	
Date	Tipping bucket stations (rainfall, in.)					Date	Rainfall, in.
	1	2	3	4	5		
23 Jan 97	0.02					23 Jan 97	0.04
24 Jan 97		0.10	0.11				
25 Jan 97					0.11		
26 Jan 97	0.11					26 Jan 97	0.21
18 May 97					0.01	19 May 97	0.05
20 May 97	0.01						
5 Jun 97				0.28	0.32	6 Jun 97	0.38
7 Jun 97	0.14						
13 Jun 97				0.08	0.09		
15 Jun 97	0.11			0.10	0.02	15 Jun 97	0.22
16 Jun 97	0.13						
22 Jul 97	0.14			0.18	0.16	23 Jul 97	0.63
28 Jul 97					0.03	29 Jul 97	0.16
2 Sep 97	0.09			0.05	0.08	2 Sep 97	0.67
25 Sep 97	1.05			1.38	1.44	25 Sep 97	0.45
						26 Sep 97	1.48
TOTAL	3.09	2.97	2.53	2.74	2.67	TOTAL	7.37

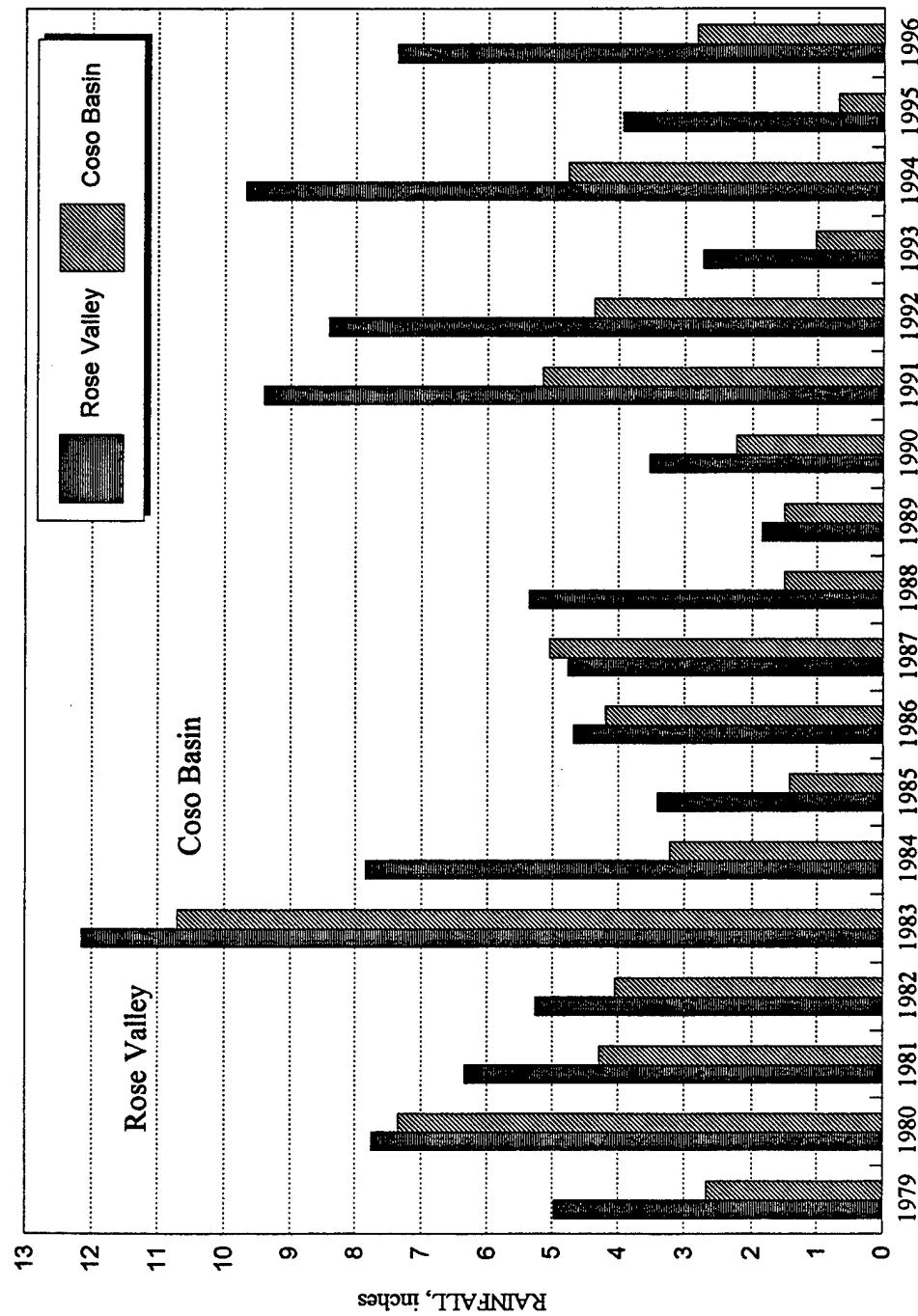


FIGURE 18. Comparison of Total Rainfall at Coso Basin and Rose Valley, 1986 Through 1996.

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TABLE 6. IWV, Rose Valley, and Coso Basin Rainfall.

Year	IWV	Rose Valley	Coso Basin
1967	4.28	4.32	
1968	3.16	3.26	
1969	5.55	8.80	
1970	3.74	6.45	
1971	1.47	2.87	
1972	1.24	1.90	
1973	2.58	4.56	
1974	7.46	9.19	
1975	1.64	2.79	
1976	3.74	8.50	
1977	4.67	8.34	
1978	10.68	12.61	
1979	5.56	4.97	2.67
1980	6.31	7.75	7.34
1981	4.49	6.34	4.28
1982	4.73	5.26	4.05
1983	10.56	12.14	10.70
1984	5.95	7.84	3.23
1985	1.29	3.42	1.42
1986	3.68	4.68	4.19
1987	4.43	4.77	5.04
1988	3.76	5.36	1.51
1989	0.94	1.85	1.51
1990	1.78	3.53	2.24
1991	7.83	9.41	5.15
1992	8.10	8.4	4.38
1993	0.94	2.74	1.04
1994	6.76	9.69	4.78
1995	7.88	3.94	0.69
1996	2.82	7.37	2.83

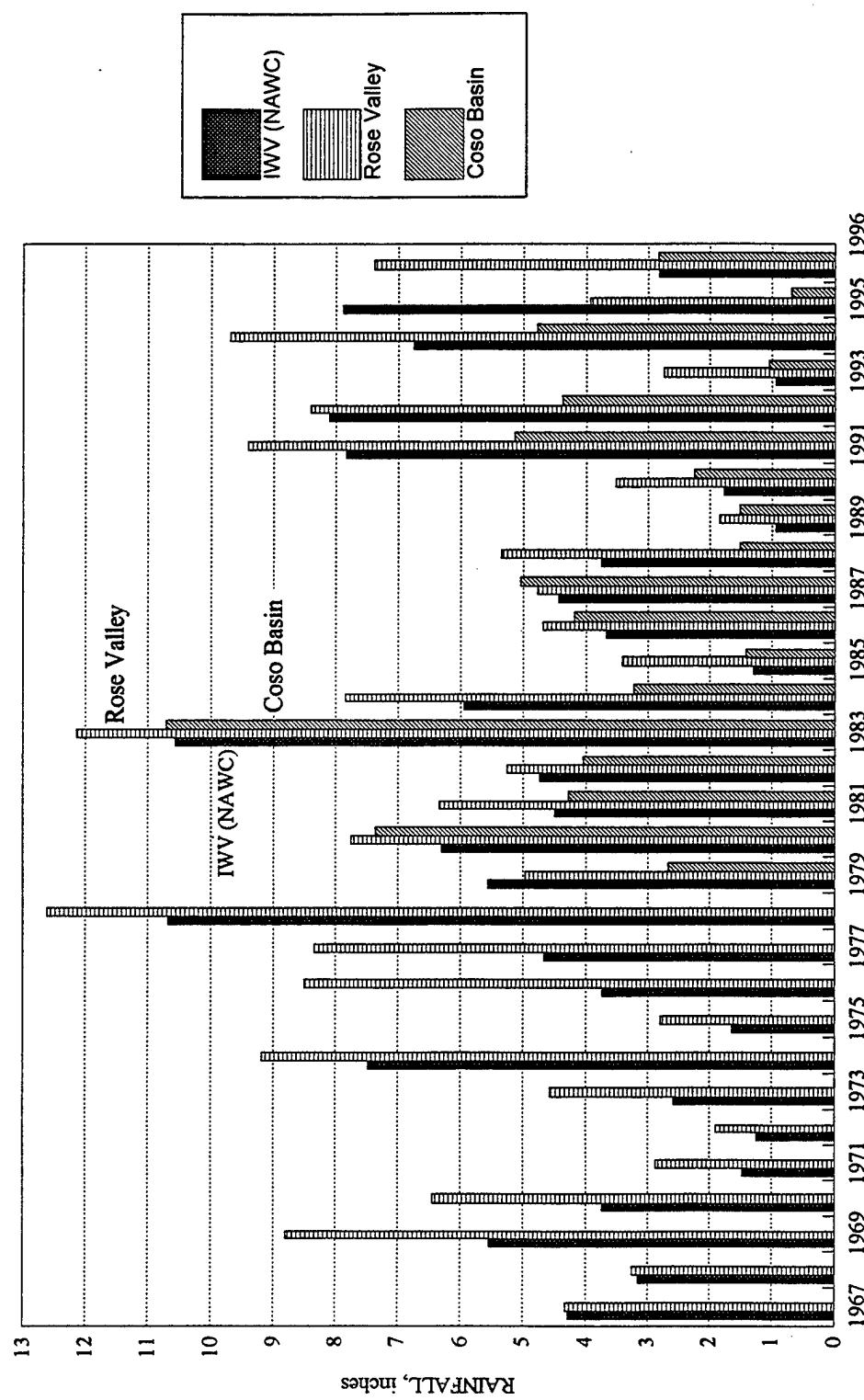


FIGURE 19. Comparison of Total Rainfall at Coso Basin, Rose Valley, and NAWC Sites, 1966 Through 1996.

**COSO HOT SPRINGS MINI-WEATHER
RECORDING STATION**

Barometric pressure, ambient temperature, relative humidity, and wind speed and wind direction are recorded at Weather Station 1, located adjacent to observation well OB-1. In March 1996 this station was integrated into the base wide weather monitoring network. This site is now maintained by NAWCWPNS Geophysics Operation personnel (Code 521410D).

Barometric pressure, ambient temperature, and relative humidity data are presented in Figure 20. Actual hourly data are expansive and will not be published. It is available from the Geothermal Program Office upon request.

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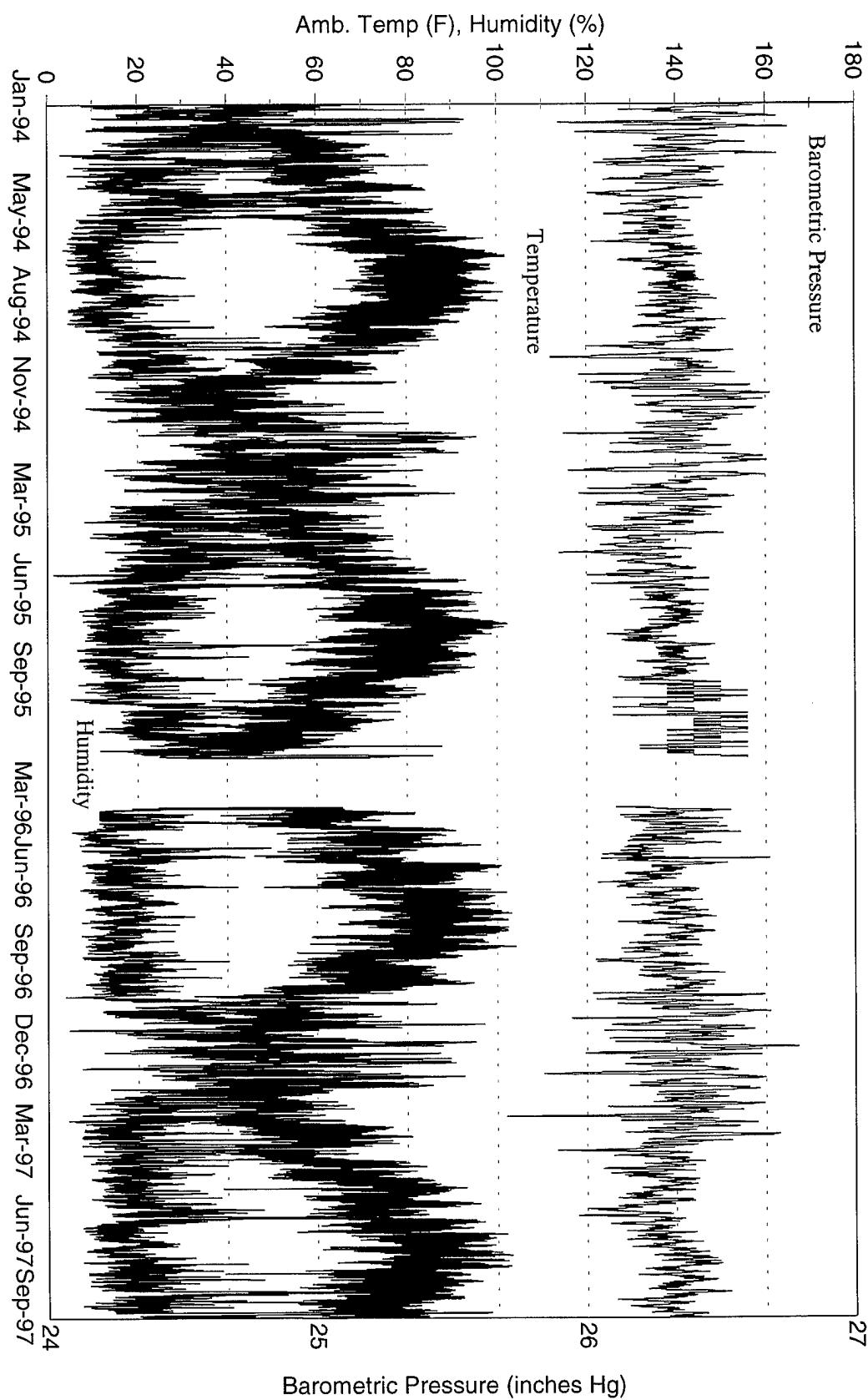


FIGURE 20. Weather Station One, Hourly Data, 19 January 1994 Through 30 September 1997.

WATER ANALYSIS OF COSO HOT SPRINGS AREA

Water samples were collected from several sites in the Coso Hot Springs area. These samples were analyzed for a suite of geothermal constituents by NAWCWPNS' Environmental Analysis Facility (Codes 4B2300D/474230D). The results are provided in Table 7. Wells 4K-1, 4P-1, and OB-1, as well as sites at Devils Kitchen, South Pool, West Canyon, and the Nichol Pool, were analyzed.

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Constituents	Units	OB-1 8/18/97	4K-1 3/24/97	4K-1 8/15/97	4P-1 3/24/97	4P-1 8/15/97	Devil's Kitchen 3/24/97	Devil's Kitchen 8/15/97													
Aluminum	mg/L	a	a	0.11	a	0.23	a	0.15	a	0.36	a	0.86	a	0.16	a	0.19	a	0.19	a	0.13	6.84
Antimony	mg/L	a	a	0.29	a	0.15	a	0.86	a	a	a	0.65	a	0.65	a	a	a	a	a	0.33	a
Arsenic	mg/L	212	30	44.5	86	65.9	5.1	7.12	30.3	27.4	33.9	0.40	0.40	0.7	0.7	0.7	0.7	0.7	0.7	0.17	a
Bicarbonate	mg/L	23.7	1.0	0.19	0.8	0.12	5.1	5.21	6.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	5.21	a
Boron	mg/L	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
Bromide	mg/L	66.4	8.4	9.10	185.0	191.3	85.7	123.3	50.6	93.3	159.0	39.4	39.4	17.6	17.6	17.6	17.6	17.6	17.6	17.6	87.3
Calcium	mg/L	0.141	0.001	0.03402	0.034	0.00419	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
Carbonate	mg/L	1968	8	4.97	29	188	2	2.80	1159	1296	4	1.66	1.66	1	1	1	1	1	1	1	2.41
Chloride	mg/L	6310	300	294	1653	1865	4620	6170	5760	6150	4820	1186	1186	617	617	617	617	617	617	617	4280
Conductivity	μmhos/cm	a	0.05	a	0.06	a	a	0.02	0.03	a	0.526	a	0.19	a	0.399	a	0.399	a	0.399	a	0.479
Copper	mg/L	3.62	4.25	1.79	0.716	0.910	0.495	0.0	0	0	0	0	0	0	0	0	0	0	0	0	a
Fluoride	mg/L	0	0	0	0	0	a	51.9	92.8	8.0	2.72	47.5	47.5	47.5	47.5	47.5	47.5	47.5	47.5	47.5	47.5
Hydroxide	mg/L	1.59	0.04	1.13	a	a	0.12	a	0.08	0.003	3.41	36.8	36.8	0.16	0.16	0.16	0.16	0.16	0.16	0.16	24.1
Iron	mg/L	12.3	0.04	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
Lithium	mg/L	6.90	0.72	0.58	0.76	1.16	29	50.2	14	19.0	81	26.8	14	14	14	14	14	14	14	14	22.9
Magnesium	mg/L	0.35	0.09	0.03	1.03	0.43	1.90	2.40	1.20	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50
Manganese	mg/L	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a	a
Mercury	pH Units	7.16	6.22	6.82	6.46	7.14	2.34	2.28	2.50	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.58	2.54
Potassium	mg/L	245	17.9	99.7	146	35.3	51.1	122	234	234	234	234	234	234	234	234	234	234	234	234	234
Selenium	mg/L	a	a	a	a	a	0.07	a	0.042	a	0.15										
Silica	mg/L	38.8	197	208	117	106	281	234	287	342	342	342	342	342	342	342	342	342	342	342	284
Sodium	mg/L	2594	42	92.4	188	39	78.3	657	1424	61	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	149
Strontrium	mg/L	2.94	0.139	a	1.75	3.14	0.178	0.2	0.197	0.27	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.095	0.07
Sulfate	mg/L	94.1	83	82.3	70.5	88.9	1114	1754	548	710	2488	577	577	577	577	577	577	577	577	577	577
TDS	mg/L	3302	436	453	1608	1641	1588	1795	2913	2892	3830	911	911	911	911	911	911	911	911	911	911
Thallium	mg/L	0.06	a	a	a	a	a	a	0.013	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.08	
Zinc	mg/L	0.03	0.48	a	a	a	a	0.89	0.079	a	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.054

Note:
a = none detected

TABLE 7. Chemical Analysis of Coso Area Surface and Near-Surface Thermal Waters.

**TEMPERATURE RECORDINGS OF
THE COSO RESORT AREA WELLS**

The temperature logs from wells 4K-1, 4P-1, and Coso No. 1 are graphed in Figure 21, with the data listed in Tables 8 through 10. These data were recorded using the TD Probe System, manufactured by Natural Progress Instruments, Dallas, Texas.

TABLE 8. Temperature Recordings at Well 4K-1.

Depth, ft	Elevation, ft AMSL	Temperature °F on 26 March 1997
0	3658	205.6
-5	3653	205.6
-10	3648	205.6
-15	3643	205.6
-20	3638	205.6
-25	3633	205.6
-30	3628	205.6
-35	3623	205.6
-40	3618	205.6
-45	3613	205.6
-50	3608	205.6
-51	3607	205.7
-52	3606	205.6
-53	3605	205.6
-54	3604	206.8
-55	3603	206.6
-56	3602	208.0
-57	3601	209.3
-58	3600	209.5
-59	3599	209.9
-60	3598	210.1
-65	3593	212.7
-70	3588	212.9
-75	3583	214.1
-80	3578	214.9

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TABLE 9. Temperature Recordings at Well 4P-1.

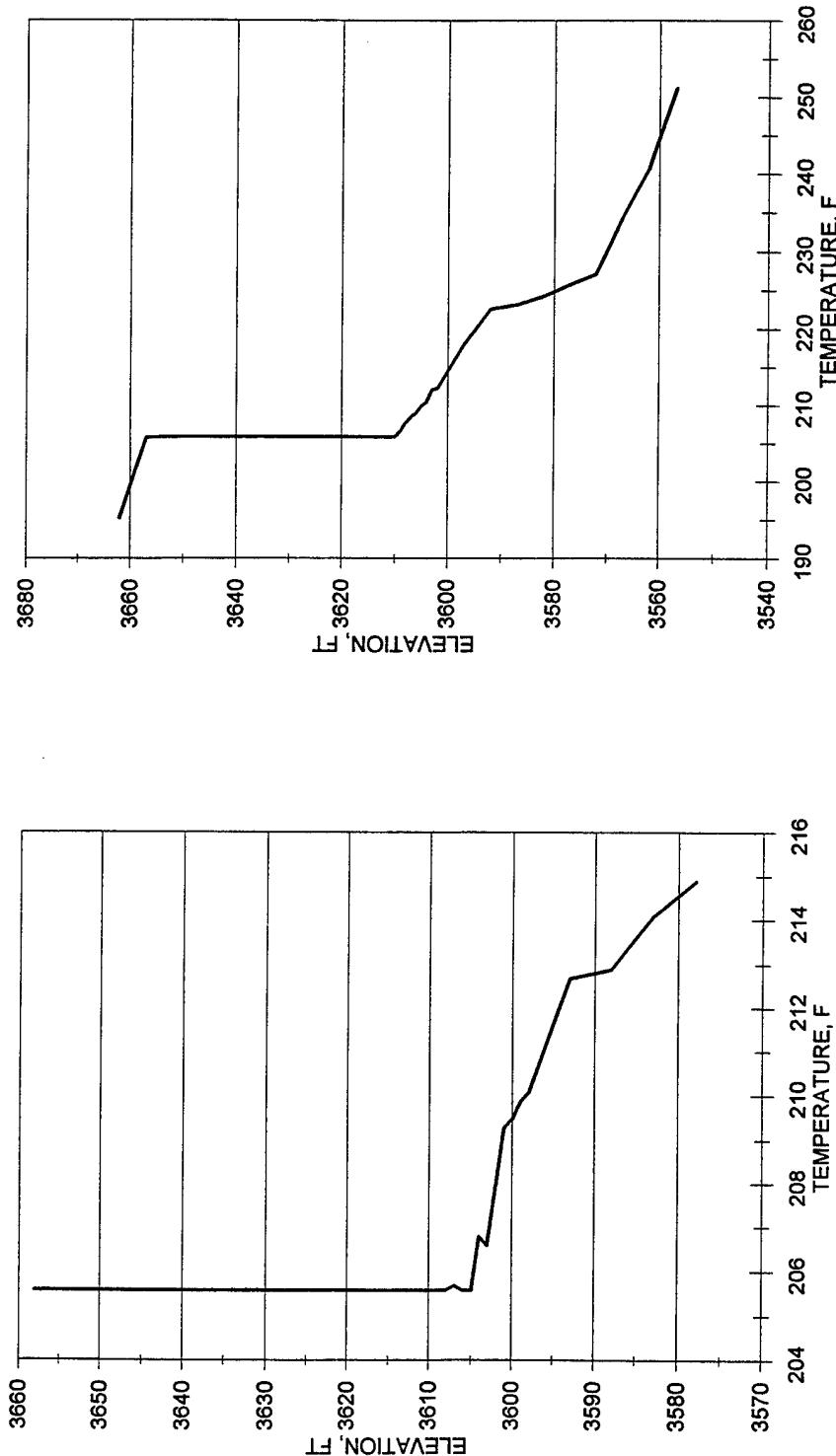
Depth, ft	Elevation, ft AMSL	Temperature °F on 26 March 1997
0	3662	195.3
-5	3657	205.8
-10	3652	205.9
-15	3647	205.9
-20	3642	205.9
-25	3637	205.9
-30	3632	205.9
-35	3627	205.9
-40	3622	205.9
-45	3617	205.9
-50	3612	205.9
-51	3611	205.9
-52	3610	205.9
-53	3609	206.7
-54	3608	207.7
-55	3607	208.5
-56	3606	209.0
-57	3605	209.9
-58	3604	210.4
-59	3603	212.0
-60	3602	212.3
-65	3597	218.1
-70	3592	222.6
-75	3587	223.2
-80	3582	224.3
-85	3577	225.8
-90	3572	227.2
-95	3567	234.5
-100	3562	240.8
-105	3557	251.3

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TABLE 10. Temperature Recordings at Coso No. 1.

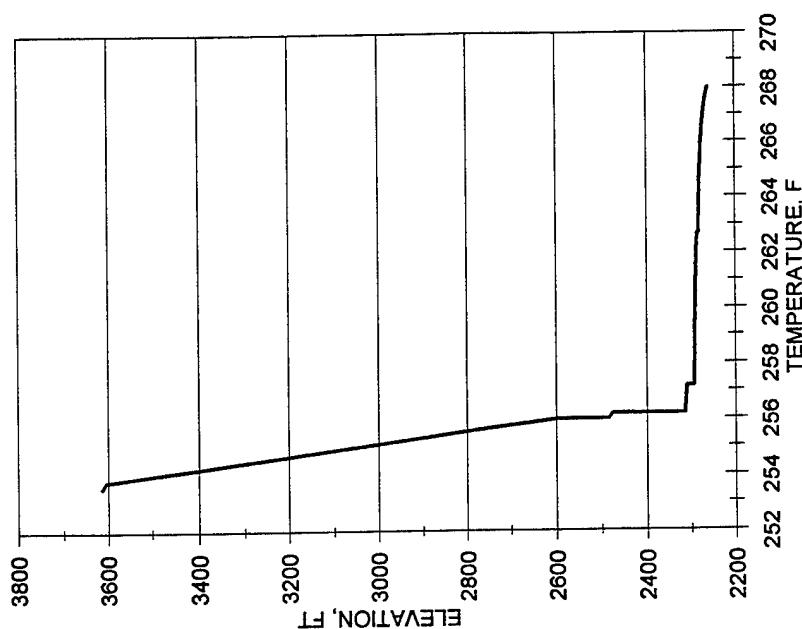
Depth, ft	Elevation, ft AMSL	Temperature °F on 26 March 1997
0	3615	253.6
-10	3605	253.8
-20	3595	256.0
-30	3585	256.0
-40	3575	256.0
-50	3565	256.0
-60	3555	256.0
-70	3545	256.0
-80	3535	256.0
-90	3525	256.0
-100	3515	256.0
-110	3505	256.0
-120	3495	256.0
-130	3485	256.0
-140	3475	256.2
-150	3465	256.2
-160	3455	256.2
-170	3445	256.2
-180	3435	256.2
-190	3425	256.2
-200	3415	256.2
-210	3405	256.2
-220	3395	256.2
-230	3385	256.2
-240	3375	256.2
-250	3365	256.2
-260	3355	256.2
-270	3345	256.2
-280	3335	256.2
-290	3325	256.2
-300	3315	256.2
-305	3310	257.2
-310	3305	257.2
-315	3300	257.2
-320	3295	257.2
-321	3294	258.0
-322	3293	258.8
-323	3292	259.5
-324	3291	260.0
-325	3290	261.1
-326	3289	261.6
-327	3288	262.2
-328	3287	262.5
-329	3286	262.7
-330	3285	262.7
-331	3284	262.7
-332	3283	262.7
-335	3282	263.3
-340	3281	264.1
-345	3276	266.2
-350	3271	267.1
-355	3266	267.6
-360	3261	268.0

FIGURE 21. Temperature Profiles



a. Well 4K-1 Temperature Gradient Log.
b. Well 4P-1 Temperature Gradient Log.

FIGURE 21. Temperature Profiles.



c. Coso No. 1 Temperature Gradient Log.

FIGURE 21. (Contd.)

OTHER GEOTHERMAL ACTIVITY AT COSO HOT SPRINGS

WEST CANYONS

The two west canyons are located approximately 0.7 km west of the Coso Resort area and on a course perpendicular to the strike-slip fault that runs north and south through the Coso Hot Springs area.

The southerly canyon, which has rain station No. 2 located at the west end, consists of hydrothermal alteration and scattered thermal activity both in the canyon and a wide area at the mouth of the canyon. The geology of this canyon indicates an extensive history of fluctuating thermal activities and features. The prominent area of present activity in the canyon includes an active steam vent bordering a vigorously boiling pool. At a greater distance up the canyon are two diminutive steam vents, small springs and fossil hot spring terrace deposits. Thermal activity in these areas is sporadic, depending upon climatic conditions. Some notable changes in the level of thermal activity have occurred here during this reporting period. An increase in the fluid discharge from the west canyon area has been noted. At first blush it would appear that this is most likely a run-off contribution from the increase in rainfall in the area during the reporting period. However, it has been demonstrated using geochemistry (both elemental and stable isotope) that the water levels in the shallow pools of the Coso Hot Springs area are not significantly affected by local rainfall.

We have no isotope data from these waters for this reporting period, but we do have two chemical analyses from March and August 1997 (Table 7). Comparing the August sample with analyses from both the March sample and samples from the past two years (NAWS-CL TP 007 and NAWS-CL TP 008) indicates a drop in the pH of the fluid (increasing acidity) coupled with a marked rise in sulfate, conductivity, TDS, and iron. Throughout this three-year period the amount of silica dissolved in the fluid has remained essentially constant. There also appears to be a small to moderate increase in the concentration of several anions and cations in the August 1997 sample.

These data imply a couple of different activities. The drop in pH coupled with the increase in sulfate can be caused by an increase of steam/non-condensable gas (H_2S and CO_2) flow into this thermal area. The increase in gas activity (bubbling in the mud/water mixture in the pool) would promote an increase in the anion/cation content of the water. Silica concentrations stay about the same because the temperature of the water doesn't vary significantly.

It is equally likely, however, that these same changes in the chemistry could be caused by rainwater collecting in the canyon, running over and percolating through the old, but hot, thermal mineral deposits, and dissolving some of the minerals. Next year's water analysis, which we will take in the spring and fall and which will include stable isotope analyses, may help to clarify the source or sources of this increased discharge.

The northerly west canyon holds an extensive area of hydrothermal alteration and fossil hot spring deposits. Present thermal activity is limited to warm-to-hot ground with a small number of steam vents. The earth slump, first noted in NAWS-CL TP 001, has continued to stabilize during the past year. Much of the slump area is warm-to-hot, with steam emanating from multiple vents, specifically along the face of the slump. The small pools of mud and steam condensate, noted in last year's summary are still present to the west of the slump.

As a whole, these sites appear to be largely unchanged from last year. One of the indicators of newly heated ground is the die-off of vegetation. The distribution of plant life in these canyons has stayed essentially unchanged.

DISCUSSION AND SUMMARY

The data recovered from each of the steam flow monitoring sites: Devils Kitchen, well 4H-4, and Schober's Resort have been considerably less erratic during the past three years than the data recovered prior to 1994. This is primarily due to the new recording equipment and a formal periodic maintenance and calibration schedule.

The water level in well 4P-1 has risen 21 feet since the beginning of the monitoring program in 1978. Most of this water level rise occurred since 1989 and seems to have stabilized at 3613.3 feet ASL. The water in this well is predominately a steam condensate and probably represents a small perched water table.

In contrast to well 4P-1 and OB-2, the water level in well OB-1 continues to drop slightly. Well OB-1 is located adjacent to the south side of Coso Wash and is clearly set in valley fill sediments, so it is unclear why the level has dropped some 40 feet since 1988. While water analyses indicate a partial geothermal fluid component, the predominant water source is clearly inflow of meteoric water from the mountains to the north and east. The groundwater around well OB-1 may still be responding to relatively low rainfall conditions in the region from 1985 through 1990, or the groundwater may just be seeking equilibrium with groundwater on the north side of the wash (represented by well OB-2).

As discussed in previous monitoring reports, the water level in Coso No. 1 is clearly influenced by the thermal activity along the hot springs fault. The level has dropped about 175 feet since 1984 due to a significant influx of heat and boiling-off of water. Since the wellhead was repaired and the well shut in, the water level appears to have stabilized.

There has been no significant change in thermal activity at the South Pool this past year. The water level continues to fluctuate seasonally, as does the water temperature, which exhibits about a ten degree (F) seasonal variation.

Additional observations:

During this reporting period, the central Coso Fault thermal area has changed moderately. The thermal area includes the old corrosion array, the Coso Resort mudfield, the South Pool, and the smaller pool and pots in between. While no new manifestation such as mud pots have formed here, the existing mud pots, craters, and fumeroles have enlarged somewhat in size. This seems to especially true just south of the South Pool where the existing mud pots not only have increased in size, the amount of fluid in the pots appears to have increased also. The Geothermal Program Office is continuing to closely monitor these changes.

The surface ground temperatures at hot spots both around the Upper Coso Wash Valley and along the periphery of the Coso Fault system have remained stable during the monitoring period. A hot spot is identified by warm-to-hot near-surface temperatures, discolored (cooked) soil, and/or die-off of vegetation. The shallow-rooted grasses, scrubs, and deep-rooted creosote bushes that have grown in these hot spots have remained the same since the last monitoring period.

This year's data, particularly that from the surface pools, pots, fumaroles, and hot spots, indicate seasonal fluctuation in temperatures and water levels; no significant increase or decrease of activity is occurring or has occurred during this monitoring period. Continuance of this monitoring program will enable us to determine if this stable trend continues.

NEW WORK

For the reporting period of 1997/98 there will be new data loggers for the tipping bucket rain gauges. The previous data loggers were out-dated and becoming unreliable. The new data loggers are all electronic and the data can be read directly into the office PC and sent to a spreadsheet where graphs can be made.

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2. _____. Coso Monitoring Program, October 1991 Through September 1992, by J. H. Monahan and K. L. Larson, Comarco Weapons Support Division, Ridgecrest, Calif. China Lake, Calif., NAWS-CL, December 1992. 123 pp. (NAWS-CL TP 001, publication UNCLASSIFIED.)

Appendix
DAILY STEAM FLOW

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4H4 Steam Flow 10/96 through 9/97				
DATE	High, lb/h	Low, lb/h	Avg, lb/h	lb/h
10/01/96	298	290	293	293
10/02/96	292	285	288	285
10/03/96	287	285	285	285
10/04/96	290	281	284	284
10/05/96	291	281	285	285
10/06/96	287	280	283	283
10/07/96	287	280	283	283
10/08/96	291	281	284	284
10/09/96	297	290	293	293
10/10/96	292	285	288	288
10/11/96	297	290	293	293
10/12/96	292	286	288	288
10/13/96	295	285	289	289
10/14/96	287	282	284	284
10/15/96	300	285	292	292
10/16/96	298	290	293	293
10/17/96	282	280	280	280
10/18/96	306	280	287	287
10/19/96	307	280	291	291
10/20/96	282	275	278	278
10/21/96	282	256	271	271
10/22/96	295	266	277	277
10/23/96	303	300	301	301
10/24/96	307	290	298	298
10/25/96	310	300	304	304
10/26/96	297	275	285	285
10/27/96	287	275	280	280
10/28/96	297	285	288	288
10/29/96	297	287	287	287
10/30/96	297	295	295	295
10/31/96	302	270	283	283
11/01/96	300	280	287	287
11/02/96	287	280	283	283
11/03/96	305	285	294	294
11/04/96	302	290	295	295
11/05/96	302	285	290	290
11/06/96	287	277	282	282
11/07/96	282	275	278	278
11/08/96	292	280	285	285
11/09/96	302	290	295	295
11/10/96	302	285	290	290
11/11/96	297	277	282	282
11/12/96	290	285	287	287
11/13/96	297	292	294	294
11/14/96	313	300	308	308
11/15/96	317	290	303	303
11/16/96	287	295	295	295
11/17/96	292	285	288	288
11/18/96	292	280	285	285
11/19/96	298	287	294	294
11/20/96	297	280	288	288
11/21/96	296	289	292	292
11/22/96	298	287	293	293

Schobers Steam Flow 10/96 through 9/97				
DATE	High, lb/h	Low, lb/h	Avg, lb/h	lb/h
10/01/96	296	293	295	295
10/02/96	295	288	290	290
10/03/96	296	285	290	290
10/04/96	295	284	290	290
10/05/96	296	285	290	290
10/06/96	297	280	288	288
10/07/96	287	280	284	284
10/08/96	291	281	284	284
10/09/96	297	290	293	293
10/10/96	292	285	288	288
10/11/96	297	290	293	293
10/12/96	292	286	288	288
10/13/96	295	289	290	290
10/14/96	293	285	290	290
10/15/96	291	285	290	290
10/16/96	293	288	290	290
10/17/96	293	288	290	290
10/18/96	295	286	290	290
10/19/96	296	288	290	290
10/20/96	293	285	290	290
10/21/96	291	280	290	290
10/22/96	296	280	290	290
10/23/96	300	290	295	295
10/24/96	307	290	298	298
10/25/96	310	300	304	304
10/26/96	297	275	285	285
10/27/96	287	275	280	280
10/28/96	297	285	288	288
10/29/96	297	287	287	287
10/30/96	297	295	295	295
10/31/96	302	270	283	283
11/01/96	300	280	287	287
11/02/96	287	280	283	283
11/03/96	305	285	294	294
11/04/96	302	290	295	295
11/05/96	302	285	290	290
11/06/96	287	277	282	282
11/07/96	282	275	278	278
11/08/96	292	280	285	285
11/09/96	302	290	295	295
11/10/96	302	285	290	290
11/11/96	297	277	282	282
11/12/96	290	285	287	287
11/13/96	297	292	294	294
11/14/96	313	300	308	308
11/15/96	317	290	303	303
11/16/96	287	295	288	288
11/17/96	292	285	288	288
11/18/96	297	292	294	294
11/19/96	298	287	294	294
11/20/96	297	280	288	288
11/21/96	296	289	292	292
11/22/96	298	287	293	293

Devils Kitchen Steam Flow 10/96 through 9/97				
DATE	High, lb/h	Low, lb/h	Avg, lb/h	lb/h
10/01/96	293	290	291	291
10/02/96	295	286	292	292
10/03/96	296	285	292	292
10/04/96	295	284	292	292
10/05/96	296	285	292	292
10/06/96	297	280	288	288
10/07/96	287	277	282	282
10/08/96	291	284	288	288
10/09/96	297	290	293	293
10/10/96	292	285	288	288
10/11/96	297	290	293	293
10/12/96	292	286	288	288
10/13/96	295	289	290	290
10/14/96	293	285	290	290
10/15/96	291	285	290	290
10/16/96	293	288	290	290
10/17/96	293	288	290	290
10/18/96	295	286	290	290
10/19/96	296	288	290	290
10/20/96	293	285	290	290
10/21/96	291	280	290	290
10/22/96	296	280	290	290
10/23/96	300	290	295	295
10/24/96	307	290	298	298
10/25/96	310	300	304	304
10/26/96	297	275	285	285
10/27/96	287	275	280	280
10/28/96	297	285	288	288
10/29/96	297	287	287	287
10/30/96	297	295	295	295
10/31/96	302	270	283	283
11/01/96	300	280	287	287
11/02/96	287	280	283	283
11/03/96	305	285	294	294
11/04/96	302	290	295	295
11/05/96	302	285	290	290
11/06/96	287	277	282	282
11/07/96	282	275	278	278
11/08/96	292	280	285	285
11/09/96	302	290	295	295
11/10/96	302	285	290	290
11/11/96	297	277	282	282
11/12/96	290	285	287	287
11/13/96	297	292	294	294
11/14/96	313	300	308	308
11/15/96	317	290	303	303
11/16/96	287	295	288	288
11/17/96	292	285	288	288
11/18/96	297	292	294	294
11/19/96	298	287	294	294
11/20/96	297	280	288	288
11/21/96	296	289	292	292
11/22/96	298	287	293	293

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4H4 Steam Flow 10/96 through 9/97						Schobers Steam Flow 10/96 through 9/97						Devils Kitchen Steam Flow 10/96 through 9/97						
DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	
11/23/96	282	270	275	11/23/96	270	275	275	11/23/96	497	478	487	11/23/96	500	478	489	11/24/96	500	478
11/24/96	282	270	275	11/24/96	270	275	275	11/24/96	500	478	489	11/24/96	503	489	496	11/25/96	503	489
11/25/96	292	280	285	11/25/96	280	285	285	11/25/96	501	487	493	11/26/96	501	487	493	11/26/96	500	484
11/26/96	290	276	285	11/26/96	276	285	285	11/26/96	500	484	491	11/27/96	500	484	491	11/27/96	500	476
11/27/96	287	280	283	11/27/96	280	283	283	11/27/96	500	484	491	11/28/96	527	510	510	11/28/96	527	484
11/28/96	324	285	303	11/28/96	285	303	303	11/28/96	500	484	491	11/29/96	498	484	484	11/29/96	498	484
11/29/96	302	282	292	11/29/96	282	292	292	11/29/96	500	484	491	11/30/96	490	478	485	11/30/96	490	478
11/30/96	277	275	275	11/30/96	275	275	275	11/30/96	500	484	493	12/01/96	507	484	493	12/01/96	507	484
12/01/96	302	280	290	12/01/96	280	290	290	12/01/96	500	484	493	12/02/96	497	455	476	12/02/96	497	455
12/02/96	287	280	283	12/02/96	280	283	283	12/02/96	500	484	493	12/03/96	503	484	496	12/03/96	503	484
12/03/96	292	270	280	12/03/96	270	280	280	12/03/96	500	484	493	12/04/96	503	484	493	12/04/96	503	484
12/04/96	287	280	283	12/04/96	280	283	283	12/04/96	500	484	493	12/05/96	516	495	505	12/05/96	516	495
12/05/96	317	285	300	12/05/96	285	300	300	12/05/96	500	484	493	12/06/96	507	484	495	12/06/96	507	484
12/06/96	317	282	298	12/06/96	282	298	298	12/06/96	500	484	493	12/07/96	491	478	485	12/07/96	491	478
12/07/96	277	274	275	12/07/96	274	275	275	12/07/96	500	484	493	12/08/96	503	484	493	12/08/96	503	484
12/08/96	295	276	290	12/08/96	276	290	290	12/08/96	500	484	493	12/09/96	507	483	495	12/09/96	507	483
12/09/96	302	295	298	12/09/96	295	298	298	12/09/96	500	484	493	12/10/96	504	488	495	12/10/96	504	488
12/10/96	297	290	293	12/10/96	290	293	293	12/10/96	500	484	493	12/11/96	496	483	487	12/11/96	496	483
12/11/96	291	280	285	12/11/96	280	285	285	12/11/96	500	484	493	12/12/96	497	483	491	12/12/96	497	483
12/12/96	288	282	284	12/12/96	282	284	284	12/12/96	500	484	493	12/13/96	497	484	490	12/13/96	497	484
12/13/96	287	280	283	12/13/96	280	283	283	12/13/96	500	484	493	12/14/96	492	480	486	12/14/96	492	480
12/14/96	277	275	275	12/14/96	275	275	275	12/14/96	500	484	493	12/15/96	497	478	489	12/15/96	497	478
12/15/96	277	272	274	12/15/96	272	274	274	12/15/96	500	484	493	12/16/96	510	489	499	12/16/96	510	489
12/16/96	301	286	292	12/16/96	286	292	292	12/16/96	500	484	493	12/17/96	501	488	495	12/17/96	501	488
12/17/96	297	280	288	12/17/96	280	288	288	12/17/96	500	484	493	12/18/96	508	484	496	12/18/96	508	484
12/18/96	287	280	283	12/18/96	280	283	283	12/18/96	500	484	493	12/19/96	508	487	499	12/19/96	508	487
12/19/96	297	290	292	12/19/96	290	292	292	12/19/96	500	484	493	12/20/96	513	491	501	12/20/96	513	491
12/20/96	309	292	300	12/20/96	292	300	300	12/20/96	500	484	493	12/21/96	514	501	509	12/21/96	514	501
12/21/96	301	286	311	12/21/96	286	311	311	12/21/96	500	484	493	12/22/96	508	486	495	12/22/96	508	486
12/22/96	317	306	321	12/22/96	306	321	321	12/22/96	500	484	493	12/23/96	482	467	474	12/23/96	482	467
12/23/96	305	282	288	12/23/96	282	288	288	12/23/96	500	484	493	12/24/96	497	478	487	12/24/96	497	478
12/24/96	280	260	267	12/24/96	260	267	267	12/24/96	500	484	493	12/25/96	508	484	496	12/25/96	508	484
12/25/96	283	265	274	12/25/96	265	274	274	12/25/96	500	484	493	12/26/96	508	489	499	12/26/96	508	489
12/26/96	302	287	293	12/26/96	287	293	293	12/26/96	500	484	493	12/27/96	507	495	501	12/27/96	507	495
12/27/96	295	280	290	12/27/96	280	290	290	12/27/96	500	484	493	12/28/96	505	489	499	12/28/96	505	489
12/28/96	305	285	300	12/28/96	285	300	300	12/28/96	500	484	493	12/29/96	497	484	490	12/29/96	497	484
12/29/96	285	281	282	12/29/96	281	282	282	12/29/96	500	484	493	12/30/96	499	484	491	12/30/96	499	484
12/30/96	287	279	283	12/30/96	279	283	283	12/30/96	500	484	493	12/31/96	501	489	495	12/31/96	501	489
12/31/96	288	285	290	12/31/96	285	290	290	12/31/96	500	484	493	12/27/96	507	495	501	12/27/96	507	495
01/01/97	288	280	283	12/27/96	280	283	283	12/27/96	500	484	493	12/28/96	505	489	499	12/28/96	505	489
01/02/97	284	284	284	12/28/96	284	284	284	12/28/96	500	484	493	01/02/97	494	484	489	01/02/97	494	484
01/03/97	306	300	302	12/29/96	300	302	302	12/29/96	500	484	493	01/03/97	514	495	505	01/03/97	514	495
01/04/97	297	277	288	12/30/96	277	288	288	12/30/96	500	484	493	01/04/97	511	491	502	01/04/97	511	491
01/05/97	287	280	283	12/31/96	280	283	283	12/31/96	500	484	493	01/05/97	503	487	495	01/05/97	503	487
01/06/97	295	290	291	12/31/96	290	291	291	12/31/96	500	484	493	01/06/97	503	483	491	01/06/97	503	483
01/07/97	282	251	270	12/31/96	251	270	270	12/31/96	500	484	493	01/07/97	491	467	479	01/07/97	491	467
01/08/97	287	252	272	12/31/96	252	272	272	12/31/96	500	484	493	01/08/97	497	481	490	01/08/97	497	481
01/09/97	287	281	285	12/31/96	281	285	285	12/31/96	500	484	493	01/09/97	498	489	494	01/09/97	498	489
01/10/97	287	292	290	12/31/96	292	290	290	12/31/96	500	484	493	01/10/97	501	487	494	01/10/97	501	487
01/11/97	312	304	308	12/31/96	304	308	308	12/31/96	500	484	493	01/11/97	519	489	506	01/11/97	519	489
01/12/97	312	311	311	12/31/96	311	311	311	12/31/96	500	484	493	01/12/97	519	489	505	01/12/97	519	489
01/13/97	307	282	291	12/31/96	282	291	291	12/31/96	500	484	493	01/13/97	513	501	507	01/13/97	513	501
01/14/97	280	272	280	12/31/96	272	280	280	12/31/96	500	484	493	01/14/97	511	484	484	01/14/97	511	484

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4H4 Steam Flow 10/96 through 9/97			
DATE	High, lb/h	Low, lb/h	Avg, lb/h
01/15/97	276	265	269
01/16/97	272	265	268
01/17/97	278	275	276
01/18/97	278	275	276
01/19/97	292	280	285
01/20/97	302	292	295
01/21/97	293	293	296
01/22/97	296	291	293
01/23/97	300	292	296
01/24/97	292	290	290
01/25/97	287	280	283
01/26/97	293	291	291
01/27/97	297	276	287
01/28/97	272	270	270
01/29/97	286	271	279
01/30/97	288	280	285
01/31/97	290	281	285
02/01/97	298	285	292
02/02/97	297	290	293
02/03/97	297	280	288
02/04/97	287	280	283
02/05/97	296	290	292
02/06/97	280	276	276
02/07/97	286	277	280
02/08/97	295	285	288
02/09/97	294	285	288
02/10/97	312	295	300
02/11/97	290	282	283
02/12/97	288	257	263
02/13/97	280	276	275
02/14/97	286	277	278
02/15/97	295	282	285
02/16/97	282	280	285
02/17/97	292	285	288
02/18/97	280	276	275
02/19/97	295	275	285
02/20/97	322	309	315
02/21/97	290	262	274
02/22/97	267	257	261
02/23/97	295	285	285
02/24/97	301	275	286
02/25/97	272	265	268
02/26/97	264	264	263
02/27/97	278	270	274
02/28/97	297	274	285
03/01/97	296	285	290
03/02/97	287	280	284
03/03/97	287	280	285
03/04/97	297	285	290
03/05/97	305	300	302
03/06/97	298	285	289
03/07/97	295	290	291
03/08/97	286	276	283

Schobers Steam Flow 10/96 through 9/97			
DATE	High, lb/h	Low, lb/h	Avg, lb/h
01/15/97	973	951	959
01/16/97	960	951	953
01/17/97	960	951	953
01/18/97	957	944	948
01/19/97	957	944	948
01/20/97	957	940	944
01/21/97	954	940	944
01/22/97	957	939	945
01/23/97	959	950	951
01/24/97	960	951	953
01/25/97	957	950	951
01/26/97	960	950	951
01/27/97	957	948	950
01/28/97	960	951	953
01/29/97	957	948	950
01/30/97	957	936	944
01/31/97	957	936	944
02/01/97	957	945	948
02/02/97	957	948	950
02/03/97	957	948	950
02/04/97	960	951	953
02/05/97	962	950	953
02/06/97	973	951	959
02/07/97	957	948	950
02/08/97	957	948	950
02/09/97	960	951	953
02/10/97	960	951	953
02/11/97	970	951	958
02/12/97	973	953	959
02/13/97	960	947	950
02/14/97	960	951	953
02/15/97	957	948	950
02/16/97	971	951	958
02/17/97	973	953	959
02/18/97	960	947	950
02/19/97	960	948	951
02/20/97	957	948	950
02/21/97	973	951	958
02/22/97	960	947	950
02/23/97	956	942	945
02/24/97	956	942	945
02/25/97	957	942	945
02/26/97	960	951	953
02/27/97	957	942	945
02/28/97	962	959	955
03/01/97	952	942	945
03/02/97	954	942	945
03/03/97	949	936	944
03/04/97	956	947	953
03/05/97	965	947	953
03/06/97	963	951	954
03/07/97	976	953	962
03/08/97	976	964	976

Devil's Kitchen Steam Flow 10/96 through 9/97			
DATE	High, lb/h	Low, lb/h	Avg, lb/h
01/15/97	519	497	497
01/16/97	491	477	485
01/17/97	494	481	487
01/18/97	494	478	486
01/19/97	506	484	497
01/20/97	500	481	490
01/21/97	487	475	481
01/22/97	503	479	488
01/23/97	491	479	486
01/24/97	498	483	490
01/25/97	498	483	490
01/26/97	501	490	496
01/27/97	508	489	499
01/28/97	507	489	498
01/29/97	503	489	496
01/30/97	497	484	493
01/31/97	504	484	494
02/01/97	508	491	501
02/02/97	508	492	501
02/03/97	503	488	495
02/04/97	503	484	493
02/05/97	503	491	497
02/06/97	500	489	495
02/07/97	492	479	486
02/08/97	497	484	490
02/09/97	501	489	495
02/10/97	493	483	487
02/11/97	500	485	493
02/12/97	500	489	495
02/13/97	494	475	485
02/14/97	496	481	489
02/15/97	495	485	490
02/16/97	501	488	495
02/17/97	514	483	495
02/18/97	492	471	481
02/19/97	491	477	483
02/20/97	498	479	489
02/21/97	503	489	497
02/22/97	497	480	489
02/23/97	498	479	485
02/24/97	504	474	488
02/25/97	495	476	483
02/26/97	511	485	490
02/27/97	517	502	491
02/28/97	497	475	485

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4H4 Steam Flow 10/96 through 9/97					
DATE	High, lb/h	Low, lb/h	Avg, lb/h	lb/h	
03/09/97	280	271	274		
03/10/97	297	277	287		
03/11/97	302	295	297		
03/12/97	289	290	289		
03/13/97	286	280	283		
03/14/97	297	285	288		
03/15/97	292	295	295		
03/16/97	291	282	284		
03/17/97	275	265	269		
03/18/97	272	260	265		
03/19/97	273	267	269		
03/20/97	302	289	293		
03/21/97	295	293	293		
03/22/97	297	287	292		
03/23/97	294	289	289		
03/24/97	284	275	277		
03/25/97	282	272	275		
03/26/97	282	280	280		
03/27/97	298	290	293		
03/28/97	292	280	287		
03/29/97	282	270	275		
03/30/97	293	277	285		
03/31/97	292	282	284		
04/01/97	284	275	280		
04/02/97	287	282	284		
04/03/97	288	282	284		
04/04/97	301	285	288		
04/05/97	308	290	298		
04/06/97	281	274	276		
04/07/97	283	274	278		
04/08/97	296	280	287		
04/09/97	287	276	283		
04/10/97	285	280	284		
04/11/97	287	275	279		
04/12/97	282	275	276		
04/13/97	287	276	282		
04/14/97	286	280	284		
04/15/97	282	275	277		
04/16/97	287	275	284		
04/17/97	282	275	276		
04/18/97	291	280	284		
04/19/97	280	279	278		
04/20/97	281	267	273		
04/21/97	288	275	283		
04/22/97	287	275	280		
04/23/97	295	289	289		
04/24/97	286	277	278		
04/25/97	277	266	271		
04/26/97	279	265	273		
04/27/97	293	277	285		
04/28/97	291	280	283		
04/29/97	280	271	274		
04/30/97	272	270	270		

Schobers Steam Flow 10/96 through 9/97					
DATE	High, lb/h	Low, lb/h	Avg, lb/h	lb/h	
03/09/97	280	271	274		
03/10/97	297	277	287		
03/11/97	302	295	297		
03/12/97	289	290	289		
03/13/97	286	280	283		
03/14/97	297	285	288		
03/15/97	292	295	295		
03/16/97	291	282	284		
03/17/97	275	265	269		
03/18/97	272	260	265		
03/19/97	273	267	269		
03/20/97	302	289	293		
03/21/97	295	293	293		
03/22/97	297	287	292		
03/23/97	294	289	289		
03/24/97	284	275	277		
03/25/97	282	272	275		
03/26/97	282	280	280		
03/27/97	298	290	293		
03/28/97	292	280	287		
03/29/97	282	270	275		
03/30/97	293	277	285		
03/31/97	292	282	284		
04/01/97	284	275	280		
04/02/97	287	282	284		
04/03/97	288	282	284		
04/04/97	301	285	288		
04/05/97	308	290	298		
04/06/97	281	274	276		
04/07/97	283	274	278		
04/08/97	288	282	284		
04/09/97	301	285	288		
04/10/97	308	290	298		
04/11/97	281	274	276		
04/12/97	283	274	278		
04/13/97	296	280	287		
04/14/97	287	276	283		
04/15/97	285	280	284		
04/16/97	287	275	279		
04/17/97	287	275	276		
04/18/97	296	280	287		
04/19/97	287	276	283		
04/20/97	285	280	284		
04/21/97	287	275	279		
04/22/97	282	275	276		
04/23/97	287	276	282		
04/24/97	286	280	284		
04/25/97	282	275	277		
04/26/97	287	275	279		
04/27/97	282	275	276		
04/28/97	291	280	284		
04/29/97	280	279	278		
04/30/97	272	270	270		

Devils Kitchen Steam Flow 10/96 through 9/97					
DATE	High, lb/h	Low, lb/h	Avg, lb/h	lb/h	
03/09/97	271	274	274		
03/10/97	297	277	287		
03/11/97	302	295	297		
03/12/97	289	290	289		
03/13/97	286	280	283		
03/14/97	297	285	288		
03/15/97	292	295	295		
03/16/97	291	282	284		
03/17/97	275	265	269		
03/18/97	272	260	265		
03/19/97	273	267	269		
03/20/97	302	289	293		
03/21/97	295	293	293		
03/22/97	297	287	292		
03/23/97	294	289	289		
03/24/97	284	275	277		
03/25/97	282	272	275		
03/26/97	282	280	280		
03/27/97	298	290	293		
03/28/97	292	280	287		
03/29/97	282	270	275		
03/30/97	293	277	285		
03/31/97	292	282	284		
04/01/97	284	275	280		
04/02/97	287	282	284		
04/03/97	288	282	284		
04/04/97	301	285	288		
04/05/97	308	290	298		
04/06/97	281	274	276		
04/07/97	283	274	278		
04/08/97	288	282	284		
04/09/97	301	285	288		
04/10/97	308	290	298		
04/11/97	287	275	279		
04/12/97	283	275	276		
04/13/97	296	280	287		
04/14/97	287	276	283		
04/15/97	285	280	284		
04/16/97	287	275	279		
04/17/97	282	275	276		
04/18/97	291	280	284		
04/19/97	280	279	278		
04/20/97	281	267	273		
04/21/97	288	275	283		
04/22/97	287	275	276		
04/23/97	295	289	289		
04/24/97	286	277	278		
04/25/97	277	266	271		
04/26/97	279	265	273		
04/27/97	293	277	285		
04/28/97	291	280	283		
04/29/97	280	271	274		
04/30/97	272	270	270		

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4H4 Steam Flow 10/96 through 9/97			
DATE	High, lb/h	Low, lb/h	Avg, lb/h
05/01/97	288	282	283
05/02/97	282	275	278
05/03/97	282	270	275
05/04/97	282	271	274
05/05/97	285	275	279
05/06/97	287	280	280
05/07/97	280	281	279
05/08/97	282	275	278
05/09/97	282	275	276
05/10/97	286	275	279
05/11/97	291	280	283
05/12/97	288	284	284
05/13/97	290	282	284
05/14/97	282	281	280
05/15/97	283	275	278
05/16/97	277	275	275
05/17/97	288	280	283
05/18/97	287	285	285
05/19/97	287	284	283
05/20/97	288	283	284
05/21/97	278	280	278
05/22/97	282	281	281
05/23/97	295	285	289
05/24/97	288	286	286
05/25/97	287	282	284
05/26/97	281	280	280
05/27/97	274	263	268
05/28/97	282	274	277
05/29/97	291	282	284
05/30/97	292	285	288
05/31/97	287	282	284
06/01/97	291	280	284
06/02/97	296	285	290
06/03/97	292	290	290
06/04/97	288	284	283
06/05/97	287	275	280
06/06/97	299	288	292
06/07/97	291	285	287
06/08/97	283	280	281
06/09/97	282	280	280
06/10/97	283	275	278
06/11/97	282	275	278
06/12/97	285	280	281
06/13/97	303	287	292
06/14/97	287	270	275
06/15/97	282	272	271
06/16/97	280	273	274
06/17/97	282	275	278
06/18/97	287	276	282
06/19/97	292	275	283
06/20/97	302	285	293
06/21/97	297	285	290
06/22/97	293	284	283

Schoobers Steam Flow 10/96 through 9/97			
DATE	High, lb/h	Low, lb/h	Avg, lb/h
05/01/97	981	970	973
05/02/97	979	967	970
05/03/97	973	964	965
05/04/97	973	964	965
05/05/97	973	962	964
05/06/97	974	961	965
05/07/97	971	962	964
05/08/97	976	965	965
05/09/97	973	964	965
05/10/97	971	964	964
05/11/97	973	964	965
05/12/97	973	962	965
05/13/97	973	965	964
05/14/97	971	964	965
05/15/97	974	958	967
05/16/97	967	953	959
05/17/97	967	954	956
05/18/97	970	954	959
05/19/97	968	954	958
05/20/97	967	954	959
05/21/97	960	951	953
05/22/97	973	944	956
05/23/97	960	951	953
05/24/97	957	936	944
05/25/97	941	933	934
05/26/97	951	936	940
05/27/97	948	936	940
05/28/97	954	948	945
05/29/97	948	936	939
05/30/97	954	939	944
05/31/97	951	936	940
06/01/97	948	933	938
06/02/97	948	936	939
06/03/97	945	936	937
06/04/97	941	933	944
06/05/97	941	933	934
06/06/97	941	928	931
06/07/97	951	929	937
06/08/97	945	936	937
06/09/97	945	936	937
06/10/97	941	933	934
06/11/97	941	933	934
06/12/97	941	933	934
06/13/97	954	936	942
06/14/97	941	923	929
06/15/97	938	929	931
06/16/97	940	922	928
06/17/97	941	931	933
06/18/97	943	933	934
06/19/97	954	920	934
06/20/97	976	951	959
06/21/97	989	976	979
06/22/97	973	951	959

Devils Kitchen Steam Flow 10/96 through 9/97			
DATE	High, lb/h	Low, lb/h	Avg, lb/h
05/01/97	981	970	973
05/02/97	979	967	970
05/03/97	973	964	965
05/04/97	973	964	965
05/05/97	973	962	964
05/06/97	974	961	965
05/07/97	971	962	964
05/08/97	976	965	965
05/09/97	973	964	965
05/10/97	971	964	964
05/11/97	973	964	965
05/12/97	973	962	965
05/13/97	973	965	964
05/14/97	971	964	965
05/15/97	974	958	967
05/16/97	967	953	959
05/17/97	967	954	956
05/18/97	970	954	959
05/19/97	968	954	958
05/20/97	967	954	959
05/21/97	960	951	953
05/22/97	973	944	956
05/23/97	960	951	953
05/24/97	957	936	944
05/25/97	941	933	934
05/26/97	951	936	940
05/27/97	948	936	940
05/28/97	954	948	945
05/29/97	948	936	939
05/30/97	954	939	944
05/31/97	951	936	940
06/01/97	948	933	938
06/02/97	948	936	939
06/03/97	945	936	937
06/04/97	941	933	944
06/05/97	941	933	934
06/06/97	941	928	931
06/07/97	951	929	937
06/08/97	945	936	937
06/09/97	945	936	937
06/10/97	941	933	934
06/11/97	941	933	934
06/12/97	941	933	934
06/13/97	954	936	942
06/14/97	941	923	929
06/15/97	938	929	931
06/16/97	940	922	928
06/17/97	941	931	933
06/18/97	943	933	934
06/19/97	954	920	934
06/20/97	976	951	959
06/21/97	989	976	979
06/22/97	973	951	959

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4H4 Steam Flow 10/96 through 9/97				
DATE	High, lb/h	Low, lb/h	Avg, lb/h	
06/23/97	291	278	282	
06/24/97	282	270	275	
06/25/97	282	270	275	
06/26/97	286	280	282	
06/27/97	288	275	281	
06/28/97	287	275	280	
06/29/97	291	277	283	
06/30/97	292	280	285	
07/01/97	287	276	281	
07/02/97	282	262	271	
07/03/97	285	275	279	
07/04/97	287	276	280	
07/05/97	287	275	280	
07/06/97	291	277	281	
07/07/97	291	275	280	
07/08/97	288	280	283	
07/09/97	287	279	282	
07/10/97	286	275	280	
07/11/97	292	275	283	
07/12/97	302	280	295	
07/13/97	297	289	292	
07/14/97	282	280	284	
07/15/97	277	270	273	
07/16/97	272	264	262	
07/17/97	276	264	269	
07/18/97	293	286	289	
07/19/97	297	281	288	
07/20/97	288	285	286	
07/21/97	287	279	282	
07/22/97	286	276	280	
07/23/97	282	275	278	
07/24/97	277	266	271	
07/25/97	288	280	283	
07/26/97	293	280	286	
07/27/97	297	290	293	
07/28/97	297	289	292	
07/29/97	297	285	290	
07/30/97	292	285	288	
07/31/97	292	285	288	
08/01/97	291	283	286	
08/02/97	288	279	280	
08/03/97	292	280	285	
08/04/97	296	285	290	
08/05/97	292	285	288	
08/06/97	292	280	285	
08/07/97	294	281	287	
08/08/97	297	276	286	
08/09/97	298	280	293	
08/10/97	297	289	292	
08/11/97	297	285	290	
08/12/97	290	280	284	
08/13/97	287	280	283	
08/14/97	284	280	281	

Schoobers Steam Flow 10/96 through 9/97				
DATE	High, lb/h	Low, lb/h	Avg, lb/h	
07/03/97	921	278	282	
07/04/97	282	270	275	
07/05/97	282	270	275	
07/06/97	286	280	282	
07/07/97	288	275	281	
07/08/97	287	275	280	
07/09/97	287	276	280	
07/10/97	286	275	280	
07/11/97	291	277	281	
07/12/97	291	275	280	
07/13/97	288	280	283	
07/14/97	287	279	282	
07/15/97	286	275	280	
07/16/97	292	275	283	
07/17/97	302	280	295	
07/18/97	297	289	292	
07/19/97	282	280	284	
07/20/97	277	270	273	
07/21/97	272	264	262	
07/22/97	276	264	269	
07/23/97	293	286	289	
07/24/97	297	281	288	
07/25/97	288	285	286	
07/26/97	287	279	282	
07/27/97	286	276	280	
07/28/97	282	275	278	
07/29/97	277	266	271	
07/30/97	288	280	283	
07/31/97	292	285	288	
08/01/97	291	283	286	
08/02/97	288	279	280	
08/03/97	292	280	285	
08/04/97	296	285	290	
08/05/97	292	285	288	
08/06/97	292	280	285	
08/07/97	294	281	287	
08/08/97	297	276	286	
08/09/97	298	280	293	
08/10/97	297	289	292	
08/11/97	297	285	290	
08/12/97	290	280	284	
08/13/97	287	280	283	
08/14/97	284	280	281	

Devils Kitchen Steam Flow 10/96 through 9/97				
DATE	High, lb/h	Low, lb/h	Avg, lb/h	
06/23/97	278	278	278	
06/24/97	282	270	275	
06/25/97	282	270	275	
06/26/97	286	280	282	
06/27/97	288	275	281	
06/28/97	287	275	280	
06/29/97	291	277	283	
06/30/97	292	280	285	
07/01/97	287	276	281	
07/02/97	287	275	281	
07/03/97	285	275	280	
07/04/97	287	276	280	
07/05/97	287	275	280	
07/06/97	291	277	281	
07/07/97	291	275	280	
07/08/97	288	280	283	
07/09/97	287	279	282	
07/10/97	286	275	280	
07/11/97	291	277	281	
07/12/97	291	275	280	
07/13/97	285	275	279	
07/14/97	287	279	282	
07/15/97	286	275	280	
07/16/97	292	275	283	
07/17/97	302	280	295	
07/18/97	297	289	292	
07/19/97	282	280	284	
07/20/97	277	270	273	
07/21/97	272	264	262	
07/22/97	276	264	269	
07/23/97	293	286	289	
07/24/97	297	281	288	
07/25/97	288	285	286	
07/26/97	293	280	286	
07/27/97	297	290	293	
07/28/97	297	289	292	
07/29/97	297	285	290	
07/30/97	292	285	288	
07/31/97	292	285	288	
08/01/97	291	283	286	
08/02/97	288	279	280	
08/03/97	292	280	285	
08/04/97	296	285	290	
08/05/97	292	285	288	
08/06/97	292	280	285	
08/07/97	294	281	287	
08/08/97	297	276	286	
08/09/97	298	280	293	
08/10/97	297	289	292	
08/11/97	297	285	290	
08/12/97	290	280	284	
08/13/97	287	280	283	
08/14/97	284	280	281	

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4H4 Steam Flow 10/96 through 9/97						Schoeters Steam Flow 10/96 through 9/97						Devil's Kitchen Steam Flow 10/96 through 9/97					
DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h	DATE	High, lb/h	Low, lb/h	Avg, lb/h		
08/15/97	297	285	290	08/15/97	926	905	912	08/15/97	491	472	482	08/16/97	491	475	483		
08/16/97	306	287	292	08/16/97	932	920	923	08/16/97	491	472	482	08/17/97	488	472	482		
08/17/97	292	285	288	08/17/97	929	920	922	08/17/97	488	468	477	08/18/97	485	468	477		
08/18/97	287	276	281	08/18/97	932	917	922	08/18/97	486	468	477	08/19/97	486	470	482		
08/19/97	288	276	282	08/19/97	929	917	920	08/19/97	486	470	478	08/20/97	486	470	481		
08/20/97	287	280	283	08/20/97	929	917	920	08/20/97	486	472	481	08/21/97	490	472	482		
08/21/97	292	280	285	08/21/97	929	920	922	08/21/97	490	474	482	08/22/97	485	468	477		
08/22/97	287	281	280	08/22/97	932	920	922	08/22/97	488	473	481	08/23/97	490	472	481		
08/23/97	289	296	284	08/23/97	932	920	923	08/23/97	490	472	482	08/24/97	491	472	482		
08/24/97	293	285	288	08/24/97	932	920	923	08/24/97	491	472	482	08/25/97	490	472	481		
08/25/97	292	285	288	08/25/97	932	920	923	08/25/97	490	472	481	08/26/97	490	474	482		
08/26/97	293	285	288	08/26/97	932	873	923	08/26/97	490	474	482	08/27/97	488	473	481		
08/27/97	291	275	286	08/27/97	935	889	925	08/27/97	488	473	481	08/28/97	527	495	507		
08/28/97	296	284	285	08/28/97	910	901	889	08/28/97	527	495	507	08/29/97	532	512	522		
08/29/97	297	284	290	08/29/97	910	929	900	08/29/97	532	512	522	08/30/97	529	512	520		
08/30/97	292	281	287	08/30/97	918	936	908	08/30/97	529	511	521	08/31/97	529	511	518		
08/31/97	293	285	287	08/31/97	941	944	933	08/31/97	529	511	518	09/01/97	526	511	518		
09/01/97	297	280	290	09/01/97	957	917	944	09/01/97	526	511	518	09/02/97	526	507	516		
09/02/97	288	270	283	09/02/97	957	908	947	09/02/97	507	516	516	09/03/97	525	508	516		
09/03/97	277	272	274	09/03/97	941	920	926	09/03/97	508	516	516	09/04/97	520	505	513		
09/04/97	282	275	273	09/04/97	926	909	914	09/04/97	520	512	518	09/05/97	525	512	518		
09/05/97	289	275	278	09/05/97	929	920	922	09/05/97	525	512	518	09/06/97	520	508	514		
09/06/97	289	275	280	09/06/97	926	920	917	09/06/97	520	511	516	09/07/97	520	511	516		
09/07/97	288	270	277	09/07/97	935	920	925	09/07/97	507	516	516	09/08/97	525	511	518		
09/08/97	289	275	275	09/08/97	940	920	926	09/08/97	511	516	516	09/09/97	520	511	516		
09/09/97	289	275	278	09/09/97	932	920	923	09/09/97	511	516	516	09/10/97	520	511	519		
09/10/97	297	281	288	09/10/97	938	920	926	09/10/97	520	511	519	09/11/97	529	509	523		
09/11/97	298	290	295	09/11/97	941	920	928	09/11/97	529	509	523	09/12/97	530	517	518		
09/12/97	298	291	285	09/12/97	935	920	925	09/12/97	517	518	518	09/13/97	525	511	509		
09/13/97	291	285	287	09/13/97	932	920	923	09/13/97	511	509	509	09/14/97	523	508	513		
09/14/97	283	280	281	09/14/97	929	920	922	09/14/97	523	508	513	09/15/97	522	505	513		
09/15/97	283	271	276	09/15/97	935	920	925	09/15/97	522	505	513	09/16/97	526	501	513		
09/16/97	287	275	280	09/16/97	935	920	925	09/16/97	501	513	513	09/17/97	519	507	513		
09/17/97	284	276	279	09/17/97	935	920	925	09/17/97	507	513	513	09/18/97	536	518	525		
09/18/97	292	280	284	09/18/97	923	920	923	09/18/97	511	509	509	09/19/97	523	508	513		
09/19/97	297	290	293	09/19/97	938	923	928	09/19/97	511	509	511	09/20/97	524	517	522		
09/20/97	290	282	284	09/20/97	926	919	920	09/20/97	517	512	521	09/21/97	531	512	521		
09/21/97	287	275	280	09/21/97	941	928	931	09/21/97	527	512	521	09/22/97	529	519	520		
09/22/97	273	265	268	09/22/97	938	929	931	09/22/97	519	507	513	09/23/97	529	513	521		
09/23/97	275	265	269	09/23/97	941	928	931	09/23/97	513	509	509	09/24/97	530	515	521		
09/24/97	283	274	276	09/24/97	943	929	933	09/24/97	530	515	521	09/25/97	535	517	526		
09/25/97	292	279	284	09/25/97	934	922	925	09/25/97	535	517	526	09/26/97	531	516	523		
09/26/97	298	291	294	09/26/97	923	914	915	09/26/97	531	516	523	09/27/97	529	512	520		
09/27/97	293	271	279	09/27/97	926	919	917	09/27/97	529	512	520	09/28/97	532	518	524		
09/28/97	288	281	286	09/28/97	929	920	922	09/28/97	532	522	527	09/29/97	532	522	527		
09/29/97	287	276	281	09/29/97	930	920	923	09/29/97	530	520	525	09/30/97	530	520	525		
09/30/97	295	279	285	09/30/97	926	920	920	09/30/97	530	520	525						